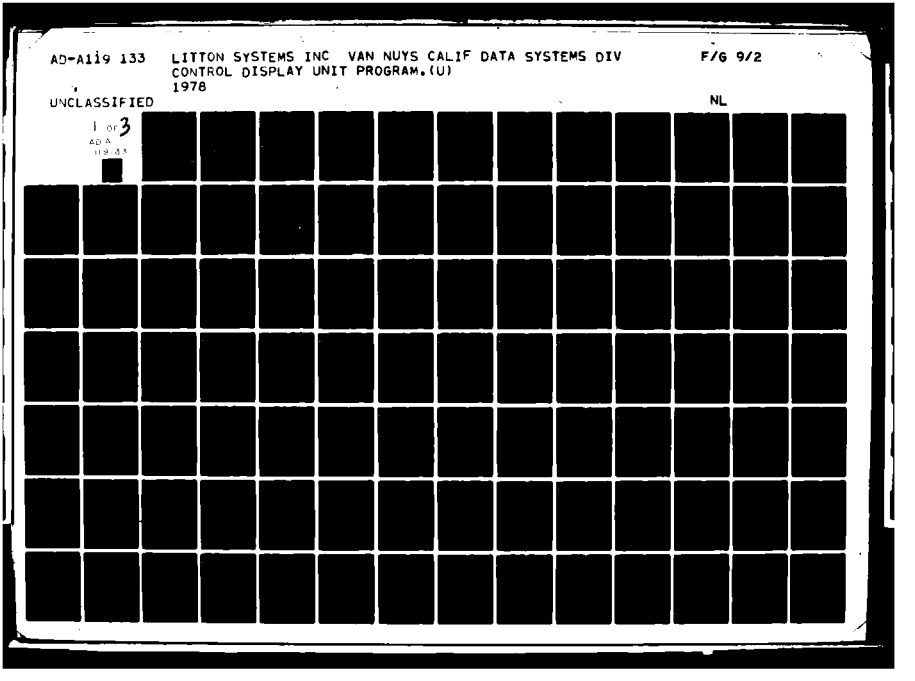
AD-A119 133 LITTON SYSTEMS INC VAN NUYS CALIF DATA SYSTEMS DIV F/G 9/2
CONTROL DISPLAY UNIT PROGRAM.(U)
1978

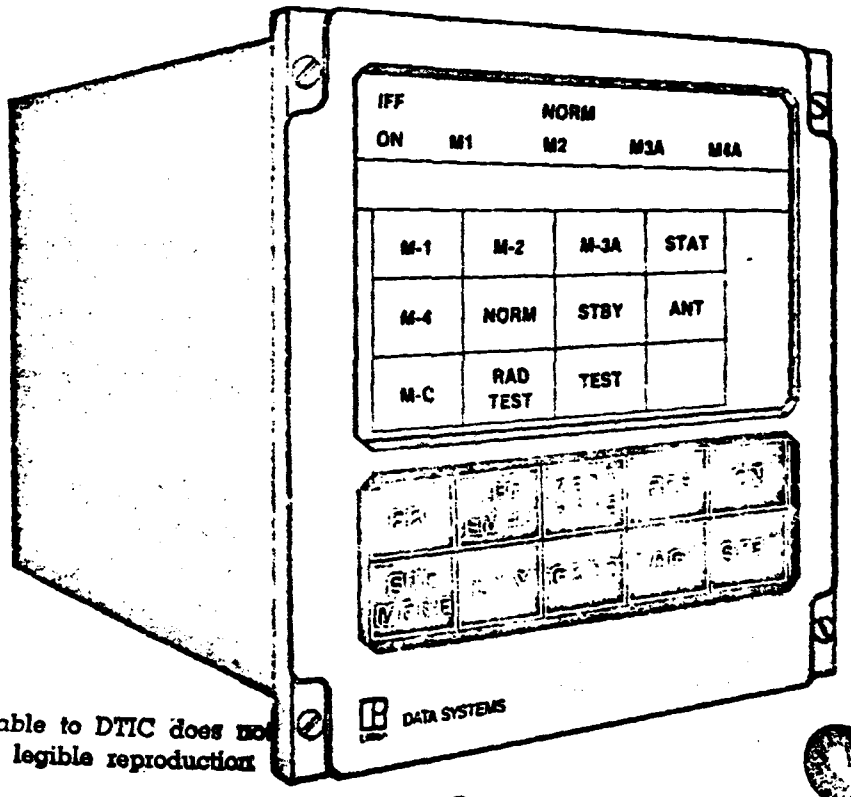
UNCLASSIFIED NL

1 OF 3
AD A
119 133



CONTROL DISPLAY UNIT PROGRAM FINAL REPORT

CLIN 004, CDRL C002



1978

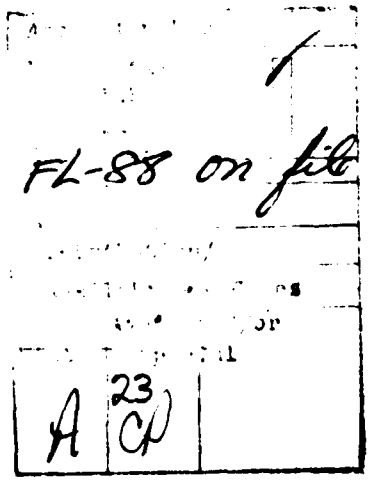
Prepared for
U. S. Army Electronics Command
Fort Monmouth, New Jersey 07703

Presented by
Litton Data Systems
8000 Woodley Avenue
Van Nuys, California 91409

12027-1A

DATA SYSTEMS

TABLE OF CONTENTS



INTRODUCTION

This information contained within this document satisfies the requirement for a final report of the Control Display Unit demonstration unit. The final report describes a Control Display Unit which, in the course of evolving, changed from a breadboard configured unit capable of physical and electrical interface to one of suitcase configuration, self-contained with dumby responses as required for presentation purposes.

It is the intent of this report to describe, by the provision of all documentation generated during the contract period, the physical and electrical elements of the suitcase Control Display Unit.

SECTION 1 DESIGN DETAILS

Schematics, Cards

Schematics, Display

Panel Membrane Switch

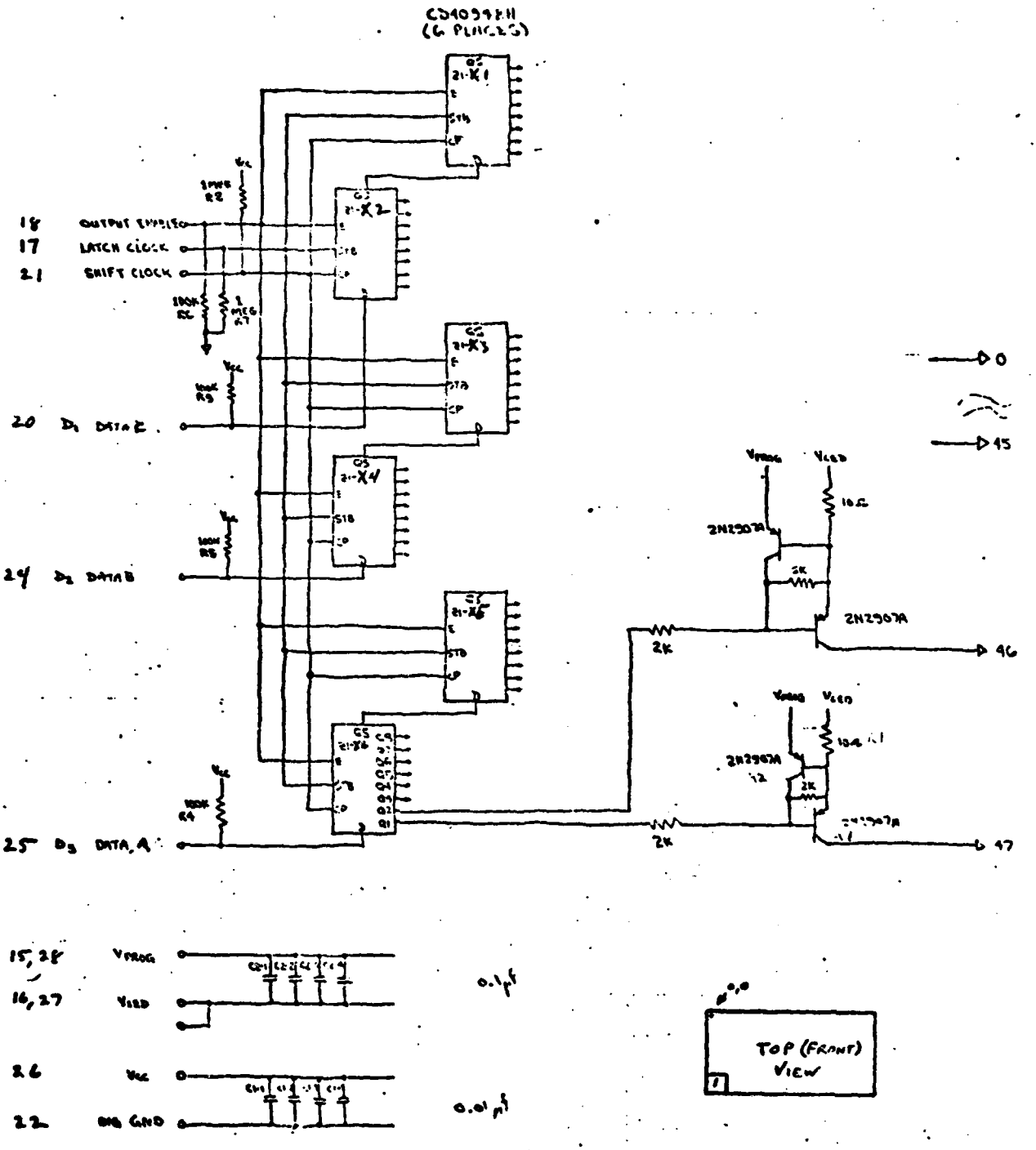
Bill of Materials

CDU

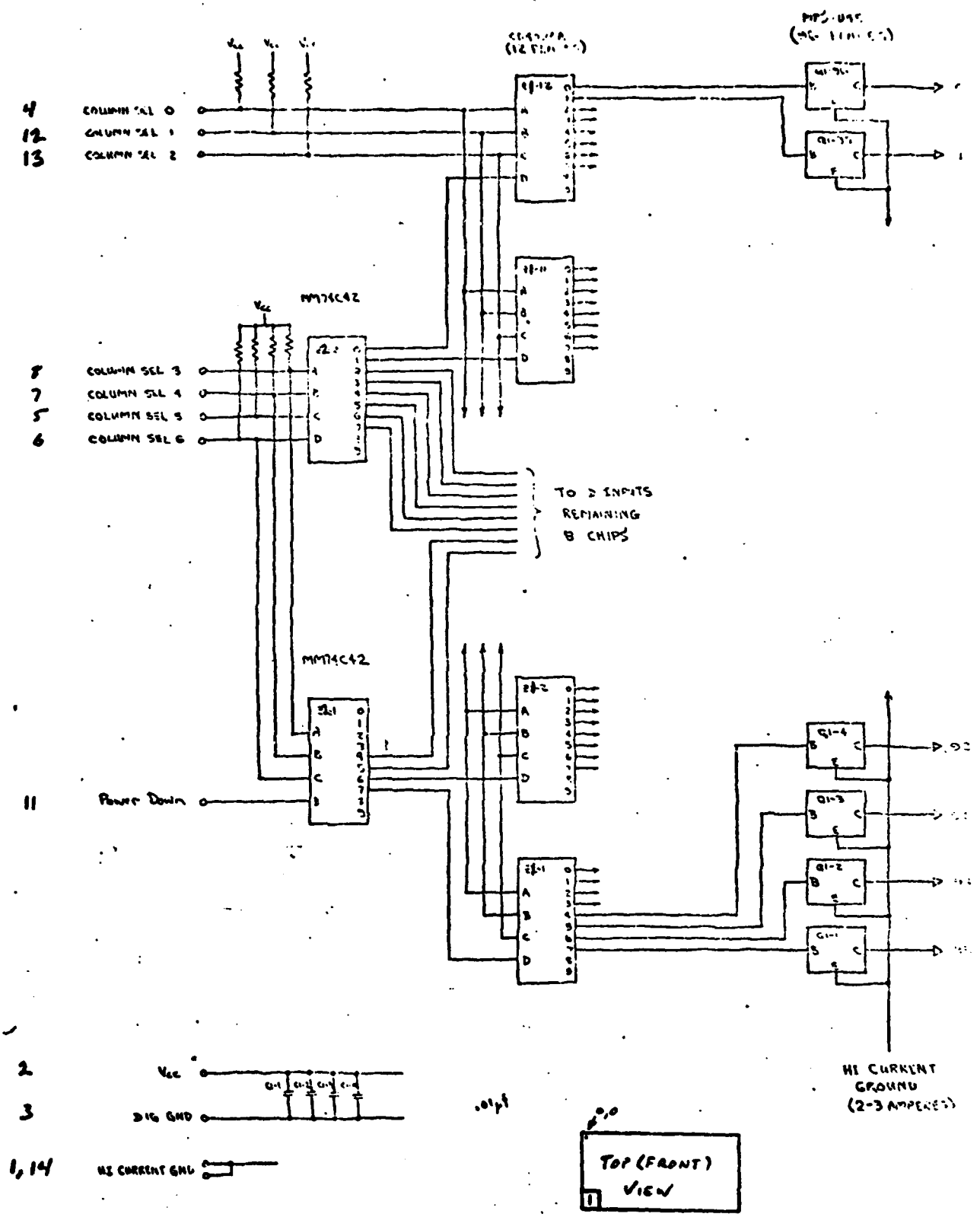
SCHEMATICS

DISPLAY

MODULE SCHEMATIC



INTERACTIVE DISPLAY
ROW DRIVERS
BAM 10-3-75



NOTES:

ALL RESISTORS 1 MEGOHM

INTERACTIVE DISPLAY COLUMN DRIVERS

CDU FRONT

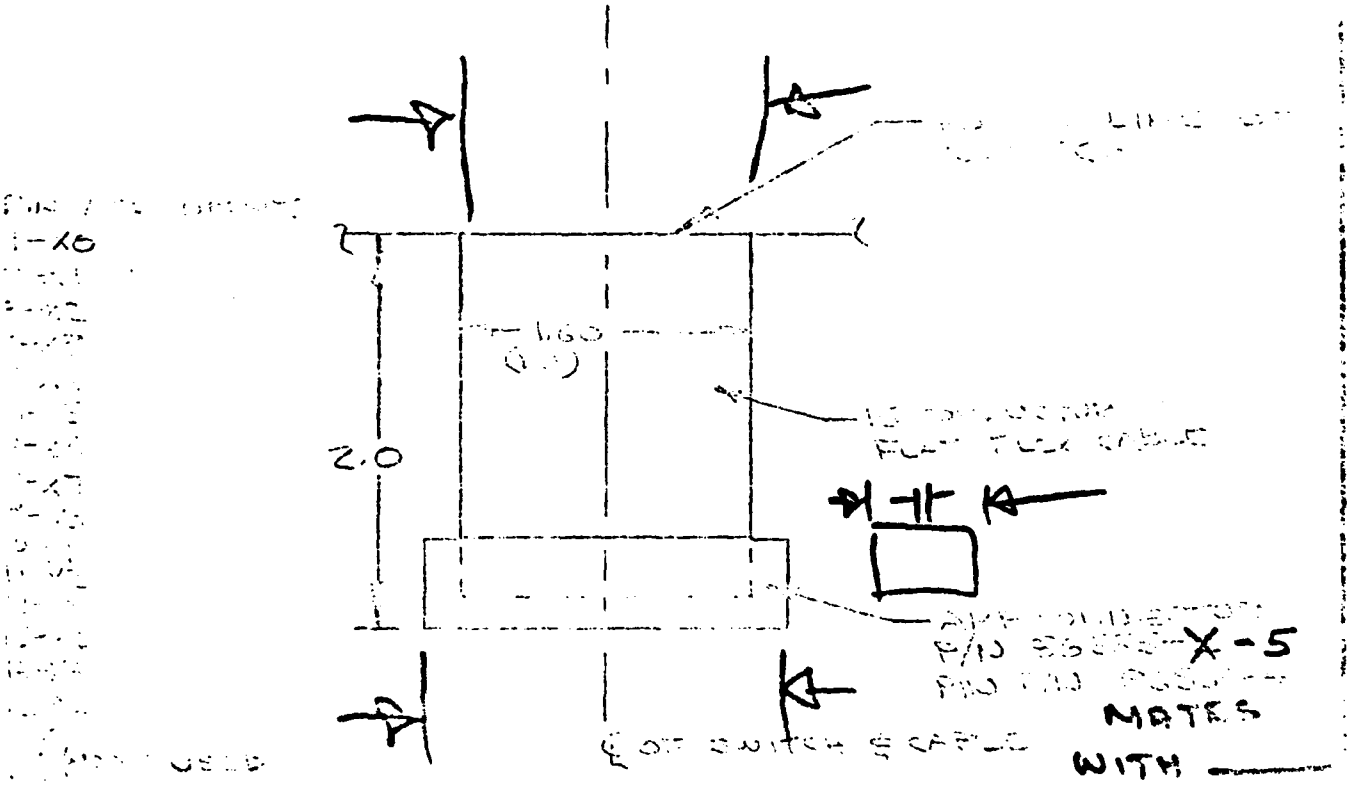
PANEL MEMBRANE

SWITCH

3. ALL BEND RADII

4. MTL & BEN PROTECTORS PER AMP DRWG —

5.

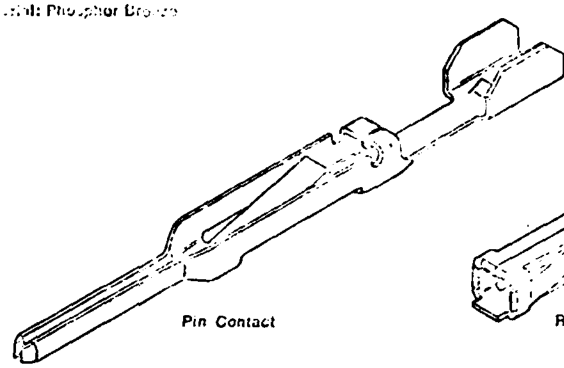


MATL		AMP INCORPORATED	
SHEET		PART	OVER LAY SWITCH
DWN			
CHK			
SCALE 1/1	SIZE A	NO. [illegible] ONLY	REV

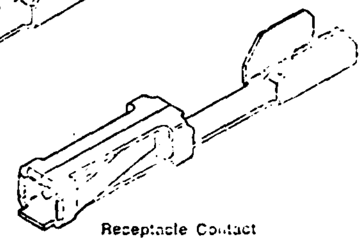
Dimensional [illegible]:
1. All [illegible] in inches and millimeters. Values in brackets are metric [illegible].
2. [illegible] dimensions in inches over millimeters.

[illegible]	
[illegible]	
Code	Plating
A	[illegible] Gold [illegible] of contact
E	[illegible]

Material: Phosphor Bronze

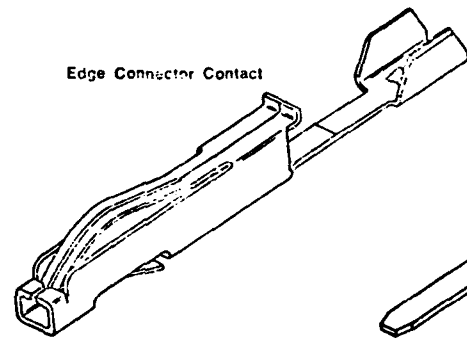


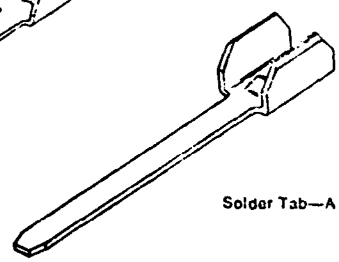
Pin Contact



Receptacle Contact

Edge Connector Contact



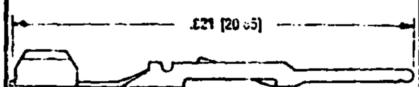


Solder Tab—A

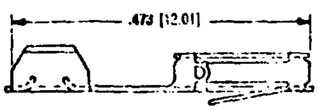
Type of Contact	Plating	Strip Form Part No.	Loose Piece Part No.
PIN	A	8[illegible]8	[illegible]
RECEPTACLE	A	[illegible]	[illegible]
EDGE CONNECTOR CONTACT	A	85/42-4	[illegible]-2

For Flexible Flat Conductor Cable Terminations

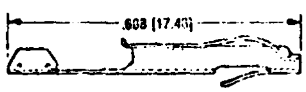
(.059/.065 [1.5/1.65] wide conductors on .100 [2.54] min. centers with ±.005 [0.13] non-accumulative tolerance, .015 [0.38] max. total cable thickness.)



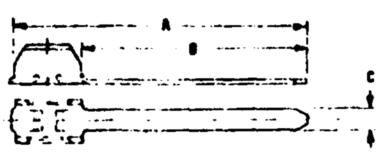
Pin



Receptacle



Edge Connector Contact

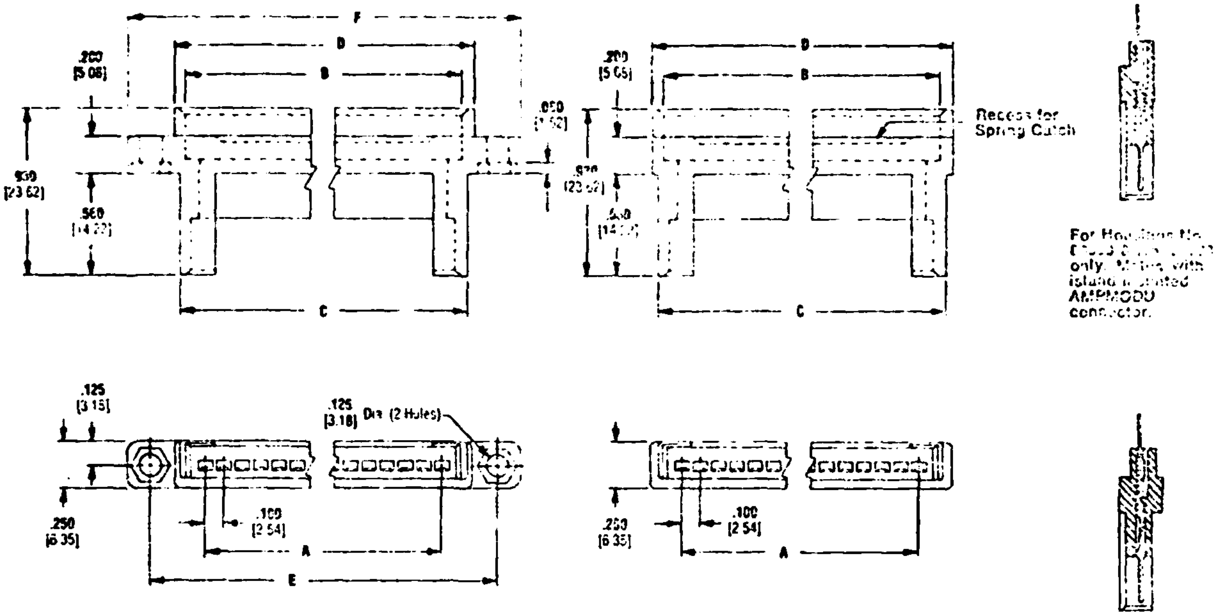


Solder Tab—A

Type of Contact	Dimensions A	Dimensions B	Dimensions C	Plating	Strip Form Part No.	Loose Piece Part No.
SOLDER TAB—A (not for use in housings)	.7[illegible]5 / 1[illegible].92	.[illegible]25 / 1[illegible]	.0[illegible] / 0.[illegible]7	E	8[illegible]74-[illegible]	[illegible]
	.3[illegible]5 / 8.76	.2[illegible]5 / [illegible].72	.027 / 0.[illegible]	E	86709-7	[illegible]
	.[illegible]5 / 10.29	.285 / 7.24	.025 / 0.64	E	86709-8	[illegible]

Single Row Pin Housings

Dimensioning:
1. All dimensions in inches and millimetres. [illegible]
2. [illegible] millimetres.



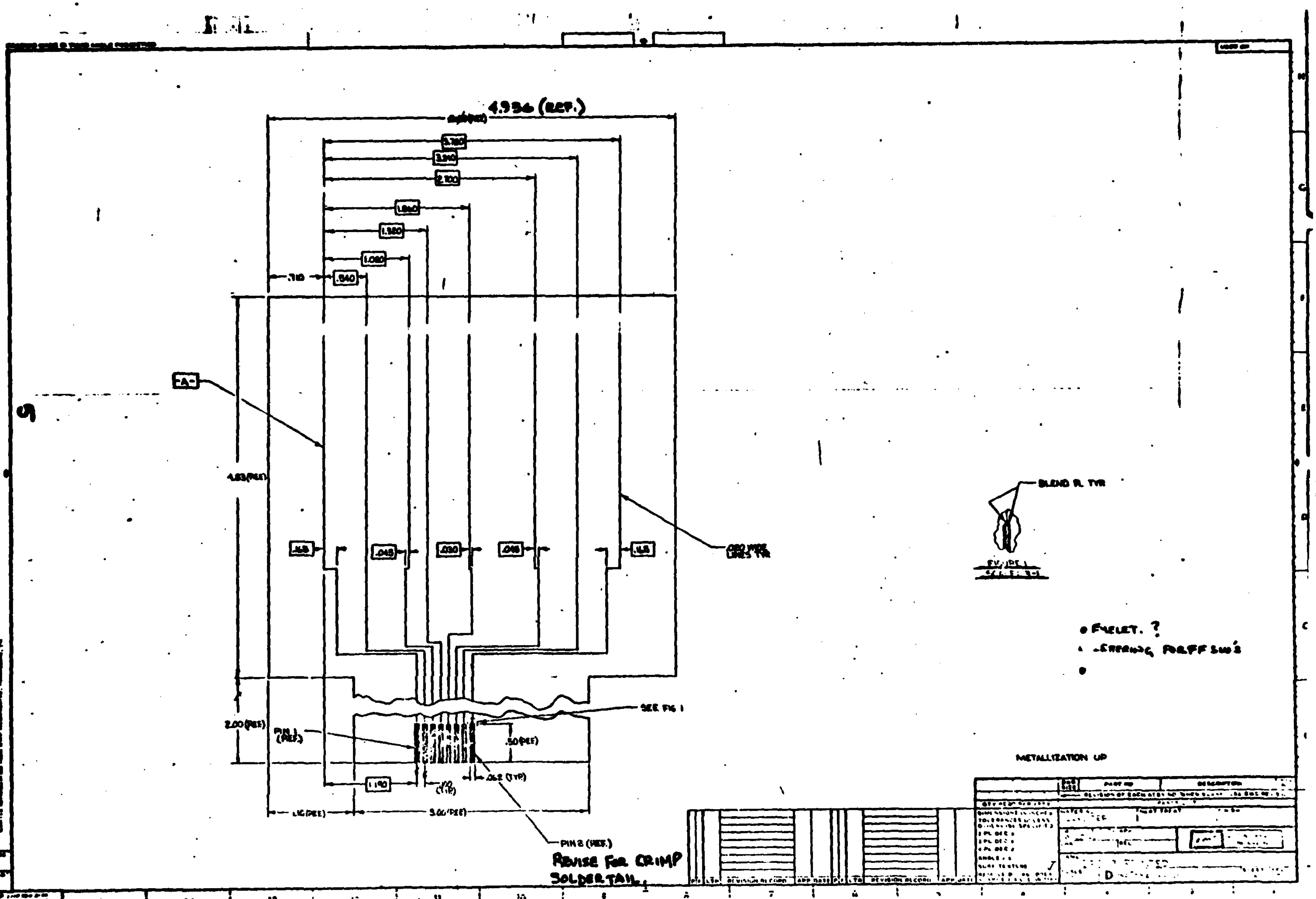
With Mounting Ears

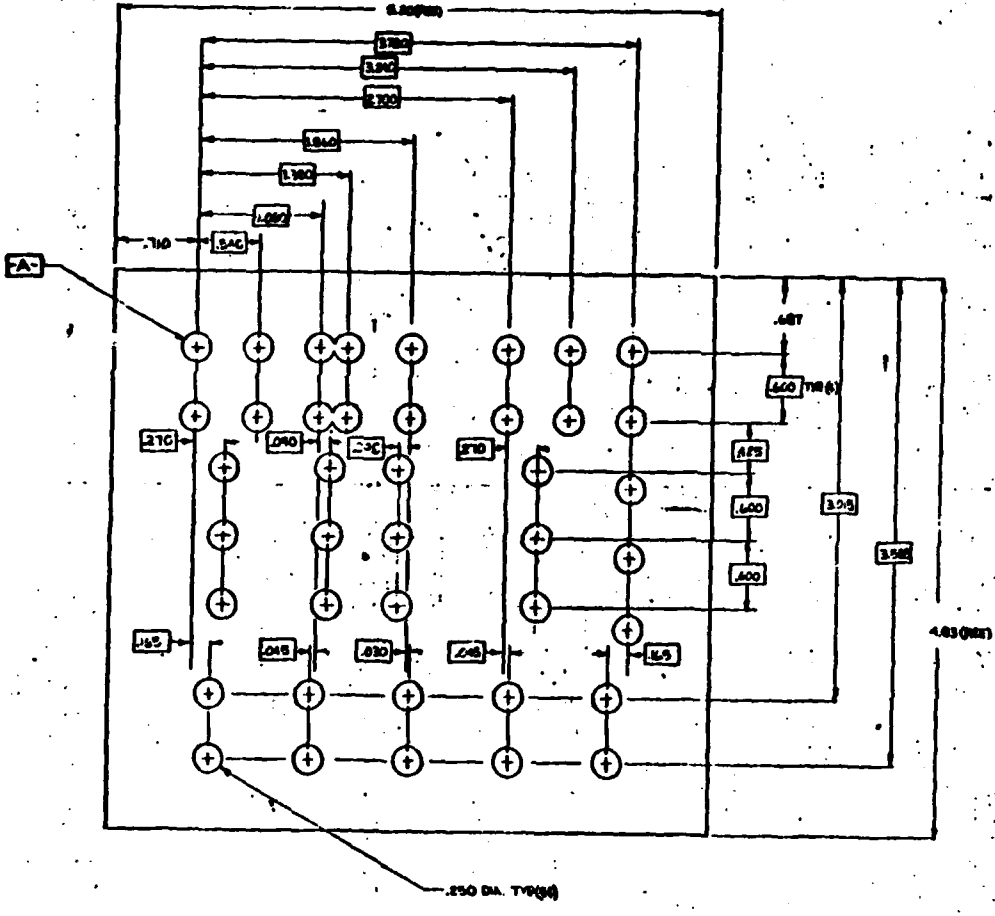
Without Mounting Ears

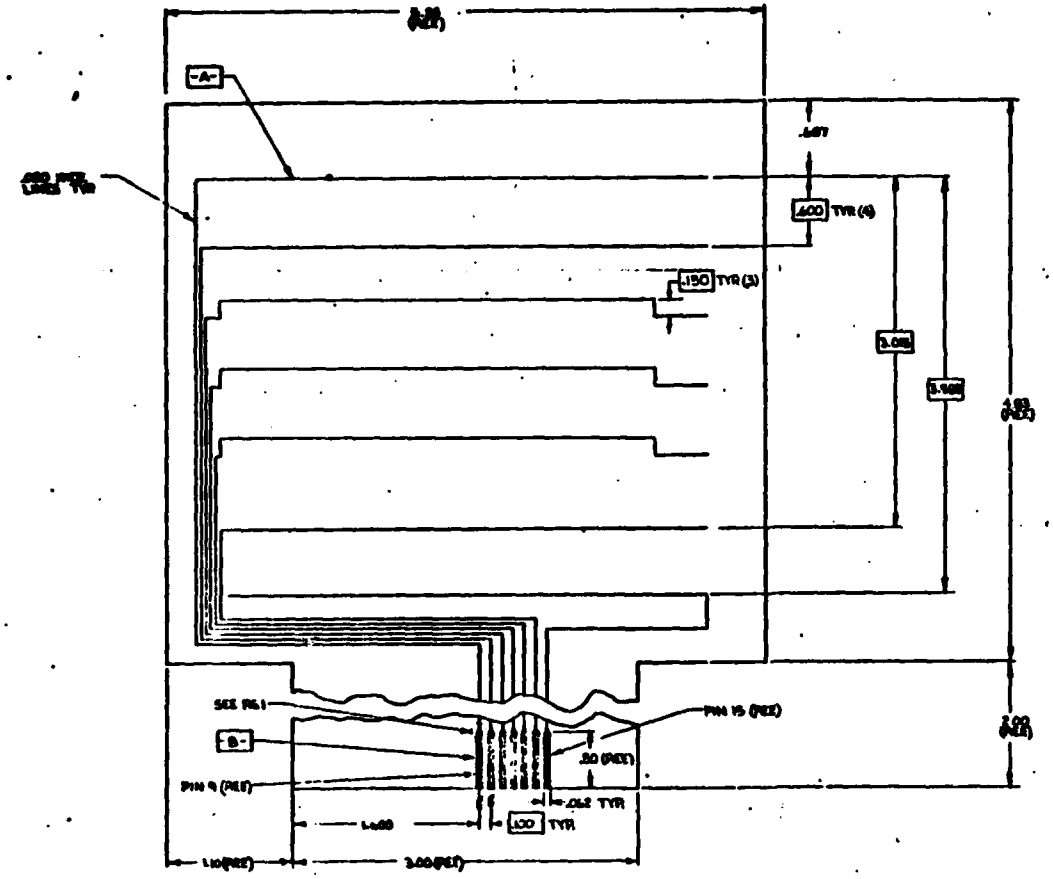
Housing Material: Black Glass Filled Nylon

No. of Positions	Dimensions A	B	C	D	E	F	Housing for Single Cable or Round Wire with Mounting Ears	Housing for Double (Daisy Chain) Cable with Mounting Ears	Housing for Single Cable or Round Wire without Mounting Ears	Housing for Double (Daisy Chain) Cable without Mounting Ears	Extraction Tool**
9	.800 / 20.32	1.026 / 26.06	1.080 / 27.43	1.150 / 29.21	1.410 / 35.81	1.660 / 42.16	86562-3	86777-1	86555-2	86776-1	91047-[illegible]
12*	1.100 / 27.94	1.326 / 33.68	1.380 / 35.05	1.450 / 36.83	—	—	—	—	86560-2	86778-1	1-91047-4
18	1.700 / 43.18	1.926 / [illegible]	1.980 / 50.29	2.050 / 52.07	2.310 / 58.67	2.560 / 65.02	86562-9	86777-9	86555-5	86776-9	1-91047-[illegible]
19*	1.800 / 45.72	2.026 / 51.46	2.080 / 52.83	2.150 / 54.61	—	—	—	—	86560-1	86778-3	91047-2
19	1.800 / 45.72	2.026 / 51.46	2.080 / 52.83	2.150 / 54.61	2.410 / 61.21	2.660 / 67.56	86562-4	86777-3	86555-1	86776-3	[illegible]
20	2.800 / 71.12	3.026 / [illegible]	3.080 / 78.23	3.150 / 80.01	3.410 / [illegible]	3.660 / 92.96	86562-2	86777-5	86555-3	86776-5	[illegible]
33	3.200 / 81.28	3.426 / 87.02	3.480 / 88.39	3.550 / 90.17	3.810 / 96.77	4.060 / 103.12	86562-1	86777-7	86555-4	86776-7	[illegible]-4

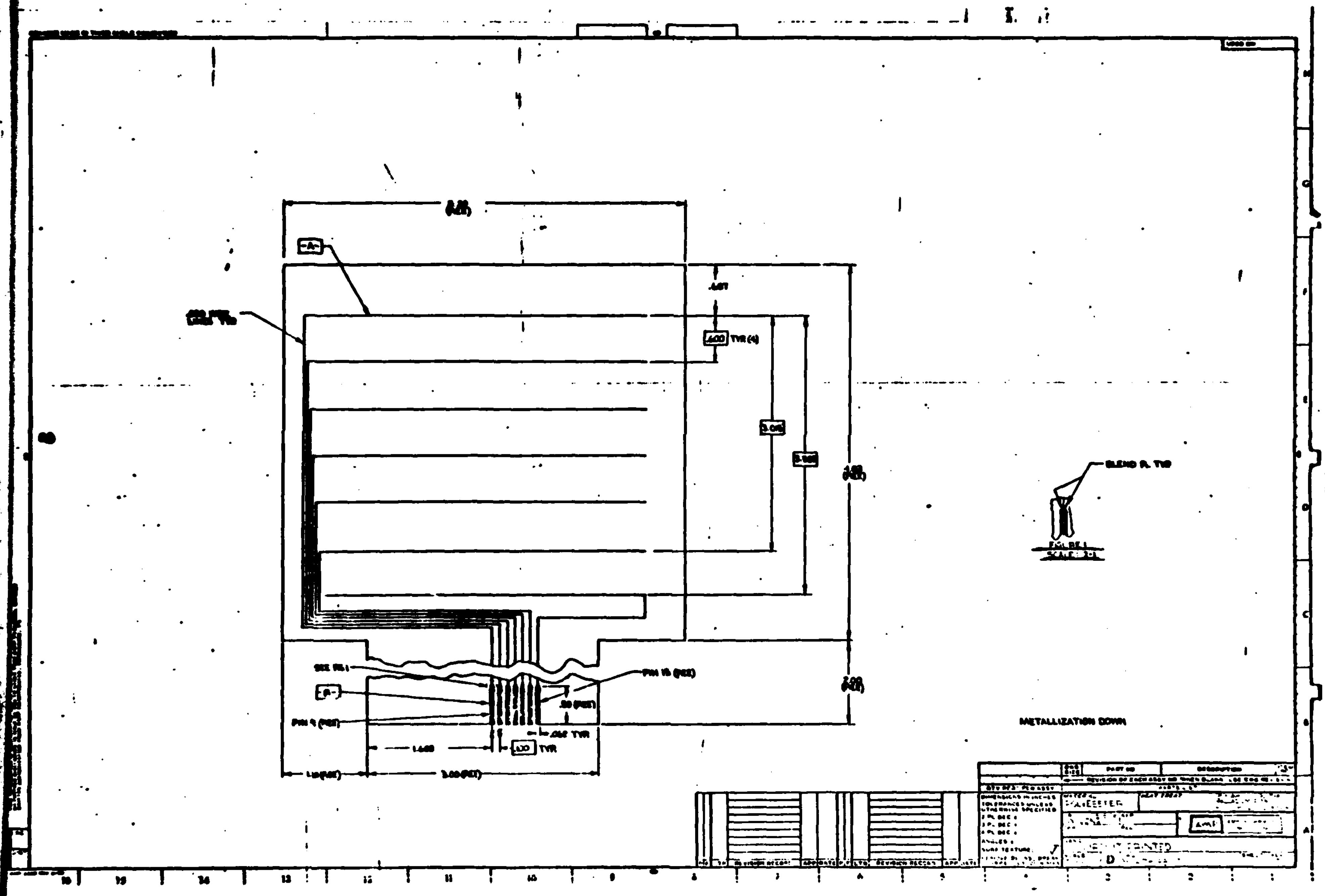
*Housings to mate with island mounted AMPMODU Connectors
**Extraction Tool Part No. 91092-1 for Round Wire Contact

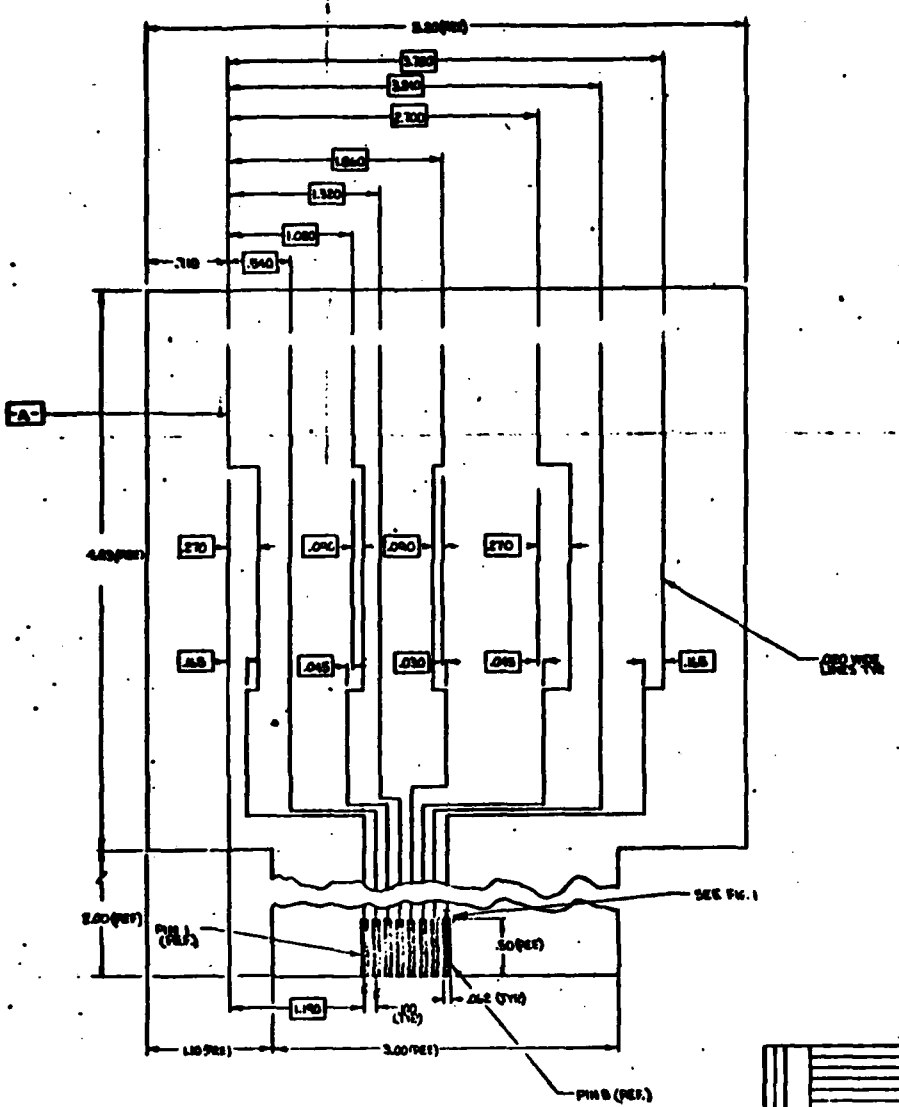

4.936 (REF.)
3.780
3.340
2.700
1.860
1.380
1.080
.940
.710
-A-
4.83(REF)
.165
.045
.030
.045
.165
.020 WIDE LINES TYP
BLEND R. TYP
2.00(REF)
PIN 1 (REF.)
SEE FIG 1
.50(REF)
1.190
.062 (TYP)
1.16(REF)
3.00(REF)
PIN 2 (REF.)
REVISE FOR CRIMP SOLDERTAIL
METALLIZATION UP
FIELET. ?


.710
.487
.250 DIA. TYP(64)

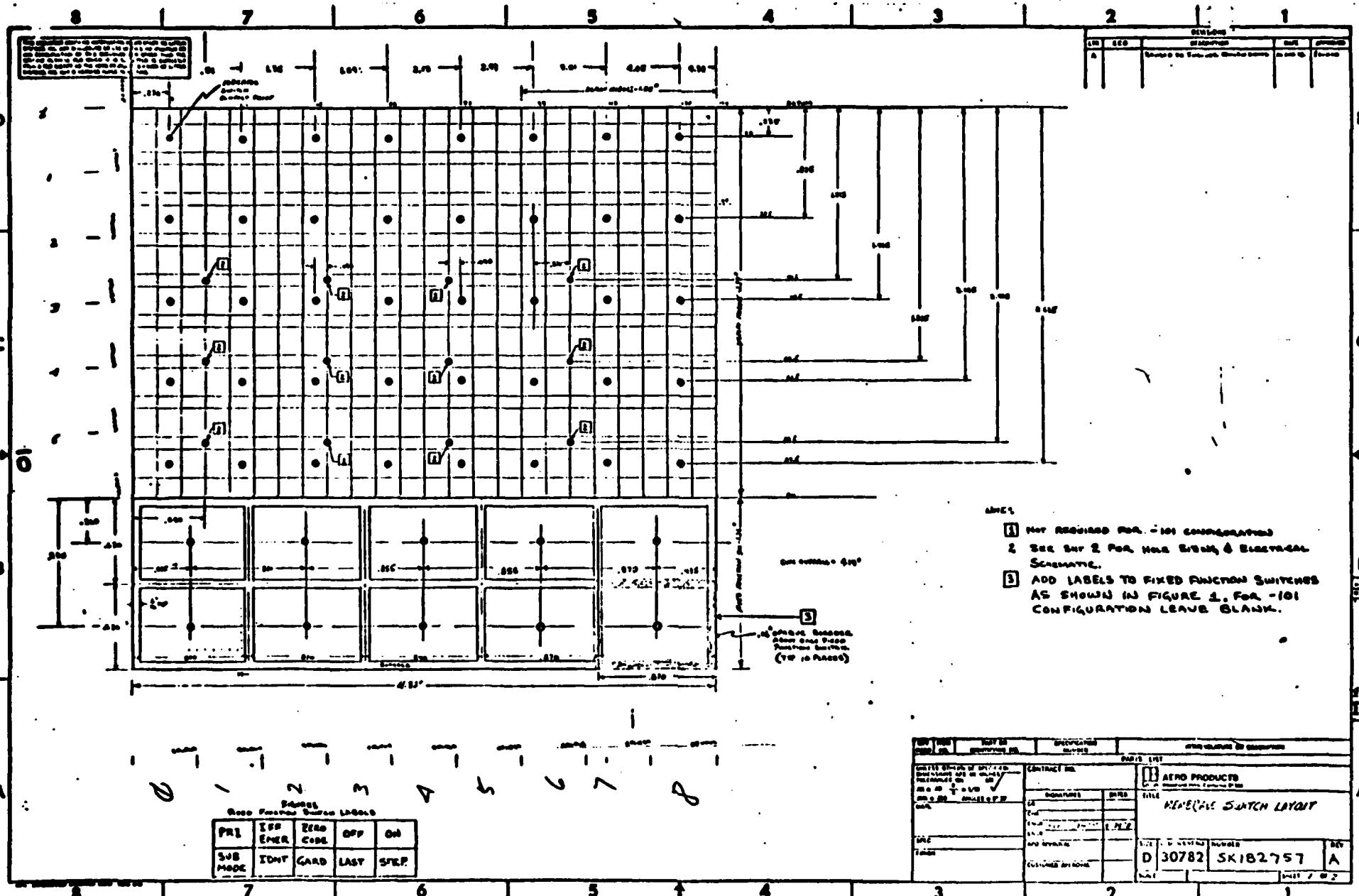


METALLIZATION DOWN


METALLIZATION DOWN
BLEND R. TYP
.400 TYP (4)
PIN 15 (REF)
PIN 9 (REF)



METALLIZATION MP



NOTES:

1. NOT REQUIRED FOR -101 CONFIGURATIONS
2. SEE SHT 2 FOR HOLE SIZES & ELECTRICAL SCHEMATIC.
3. ADD LABELS TO FIXED FUNCTION SWITCHES AS SHOWN IN FIGURE 1. FOR -101 CONFIGURATION LEAVE BLANK.

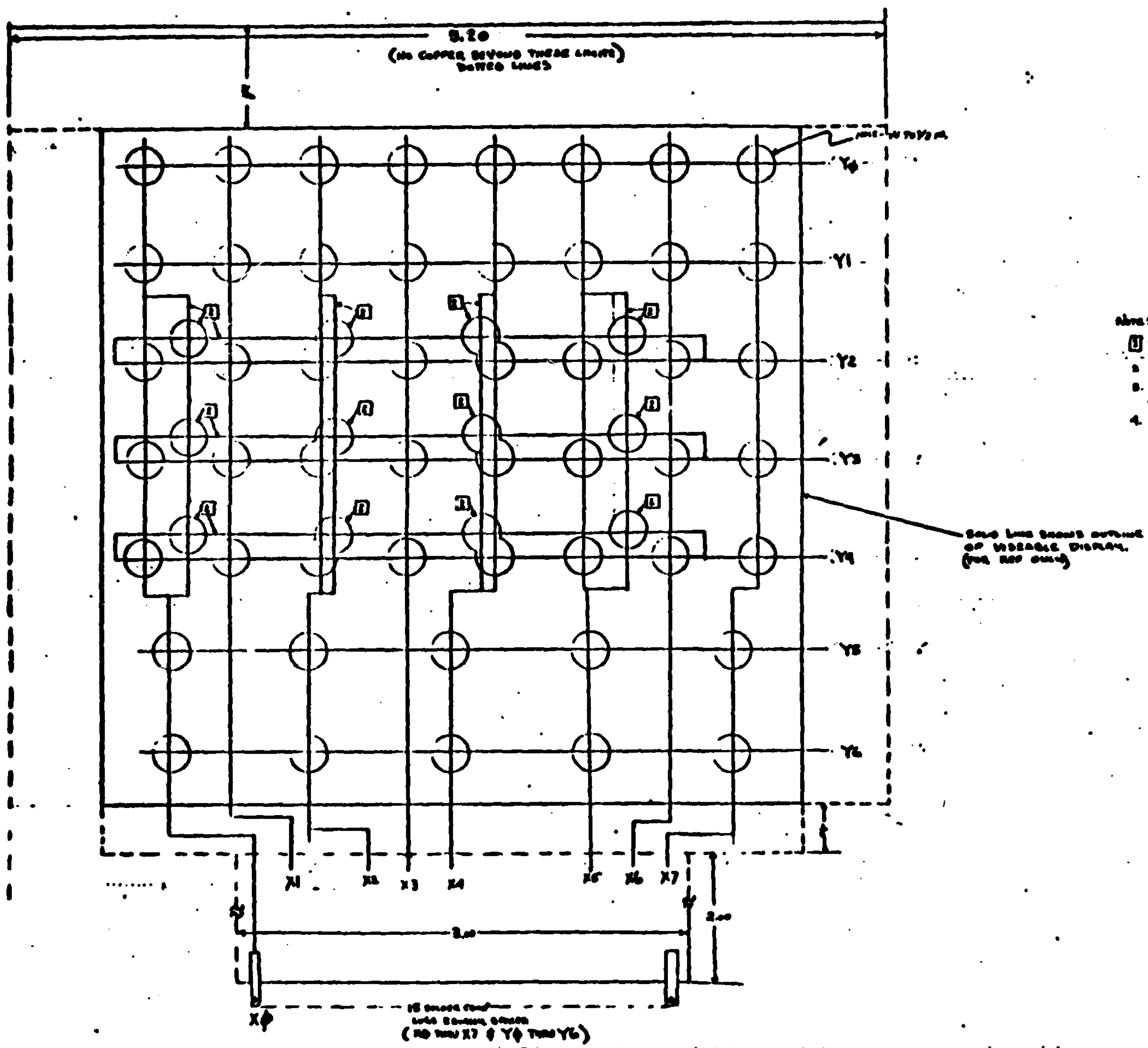
PRI	TEST EMER	ZERO CODE	OFF	ON	
SUB MODE	IDENT	GARD	LAST	STEP	

AERO PRODUCTS

TITLE: KEYBOARD SWITCH LAYOUT

SIZE D | NUMBER 30782 SK182757 | REV A

SHEET 1 OF 2



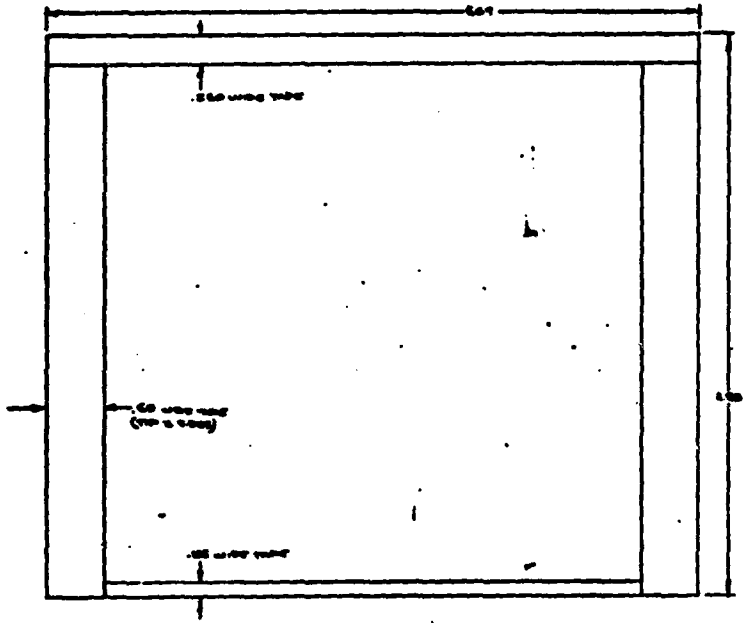
NOTE:

3. RETURN ALL EXTERNAL CONNECTIONS TO BOTTOM OF SWITCH ASSEMBLY.

4. ALL TERMINATIONS FROM BOTTOM.

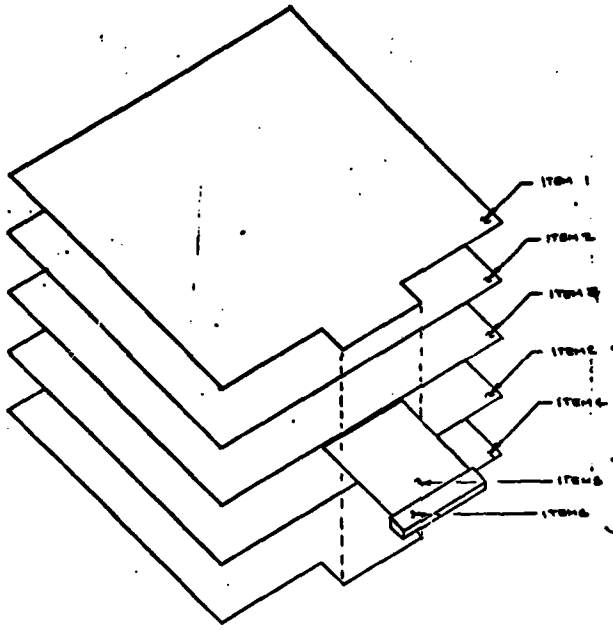
MEMBRANE SWITCH LAYOUT
SK182757

2 OF 2



PROPOSED DESIGN
NOT RELEASED FOR
PRODUCTION

CUSTOMER DRAWING



PROPOSED DESIGN
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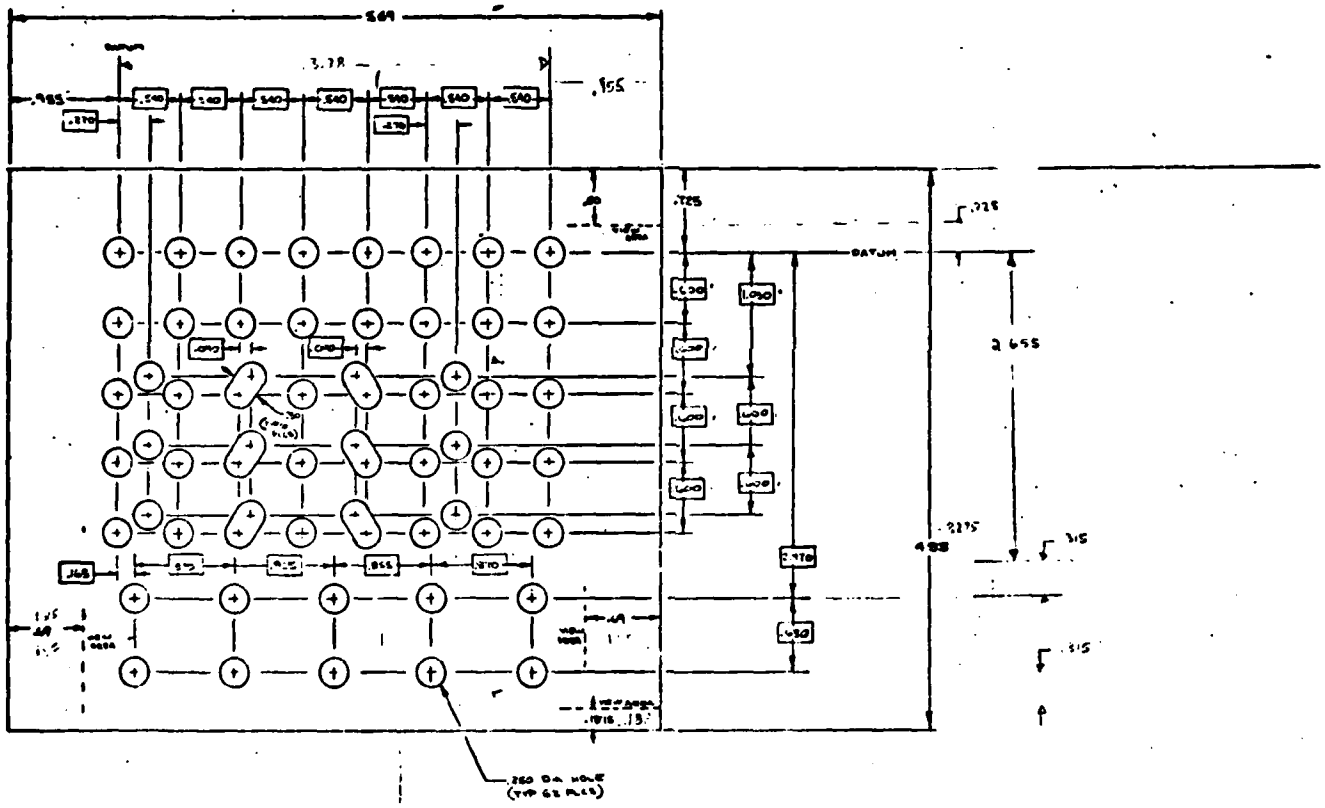
PRODUCTION

CUSTOMER DRAWING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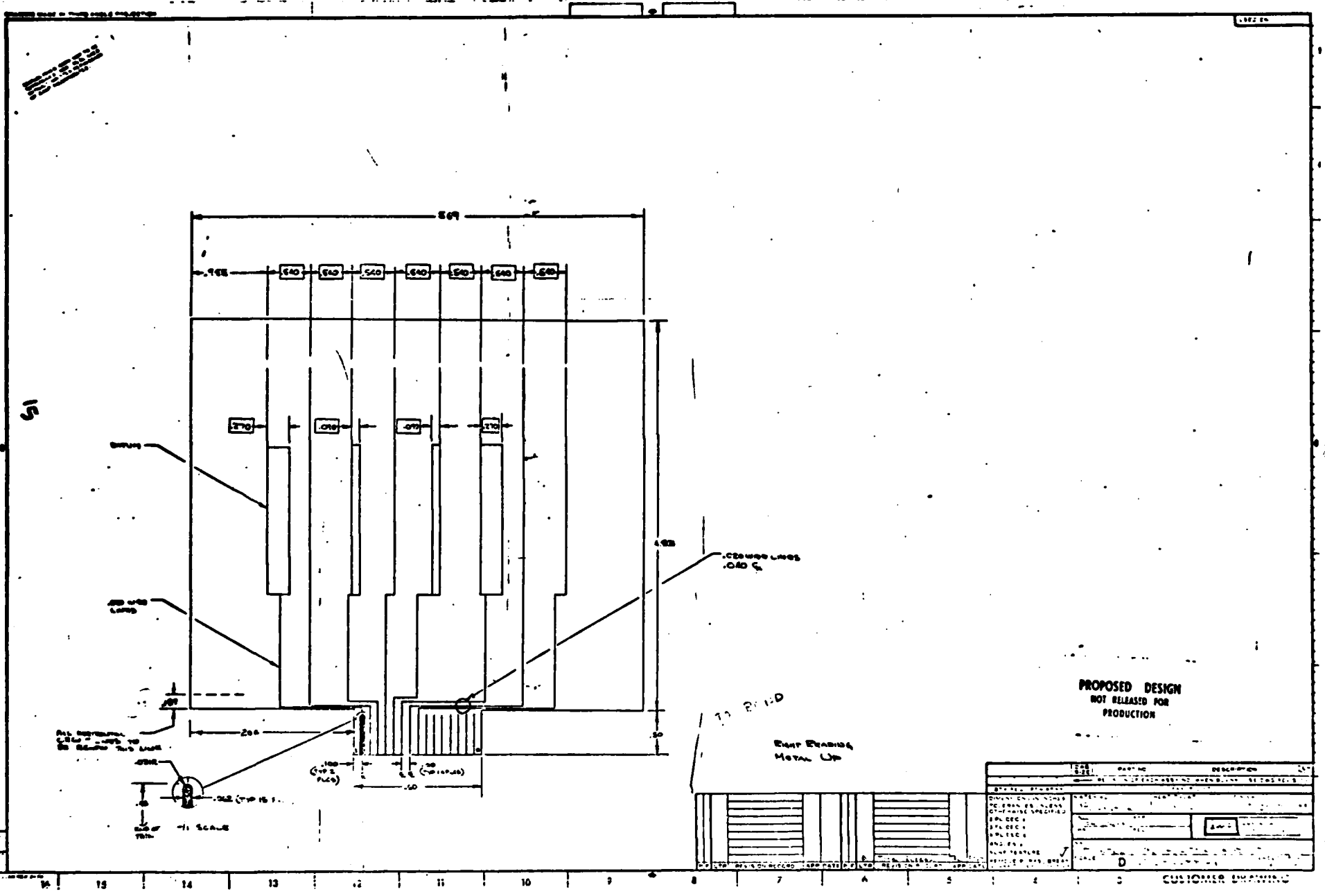
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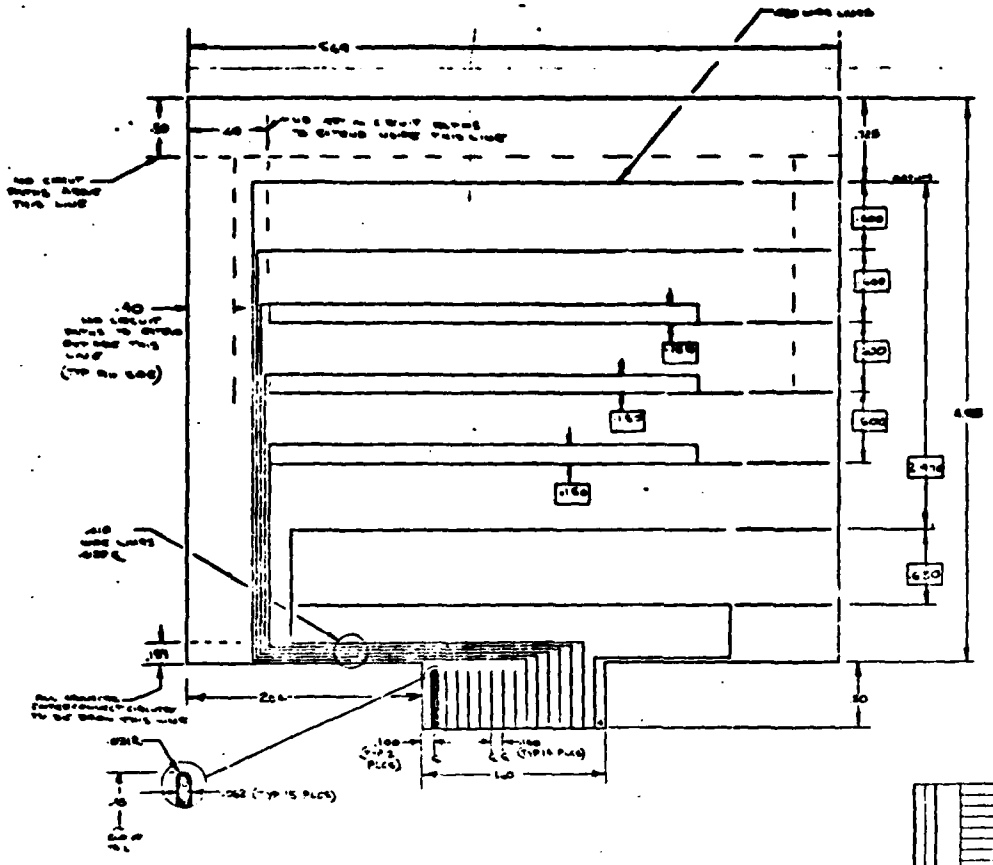

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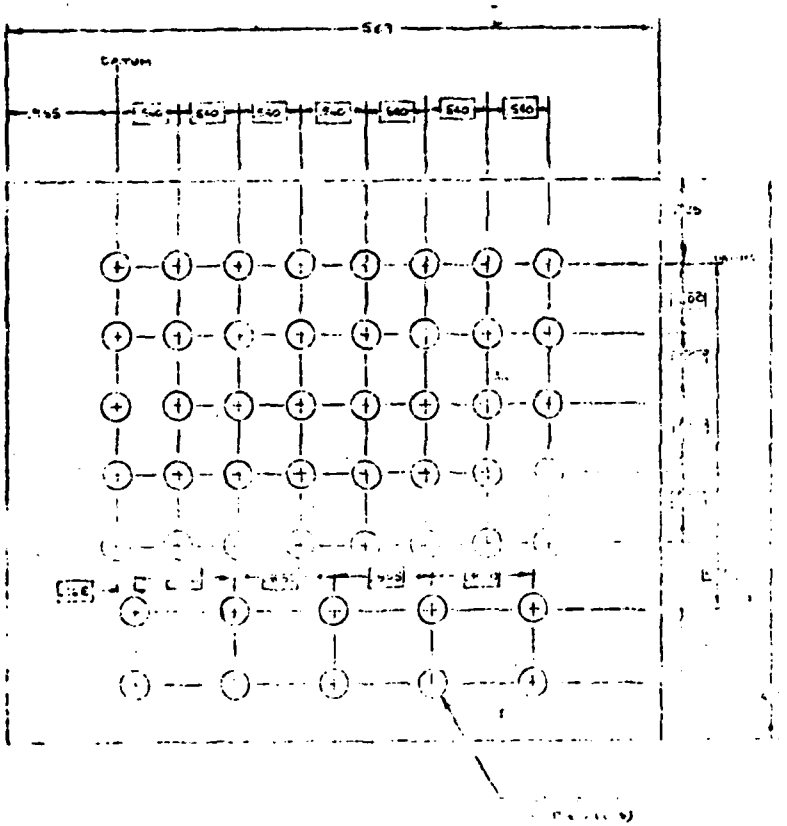
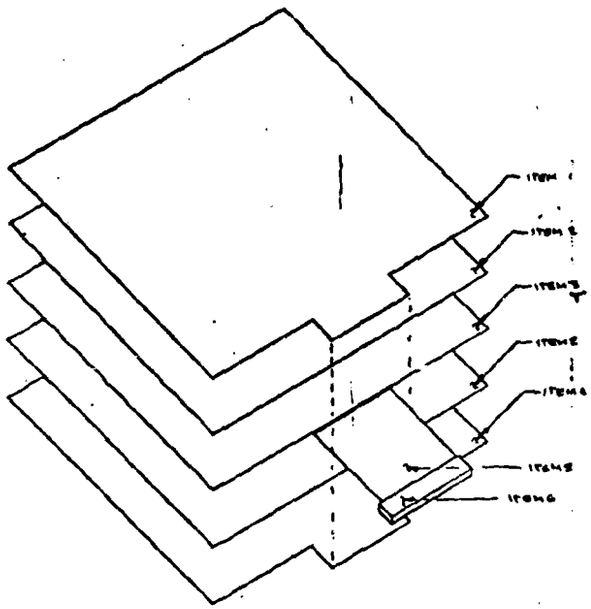
PRODUCTION

RIGHT REARSIDE
METAL DWN





PROPOSED DESIGN
NOT RELEASED FOR
PRODUCTION

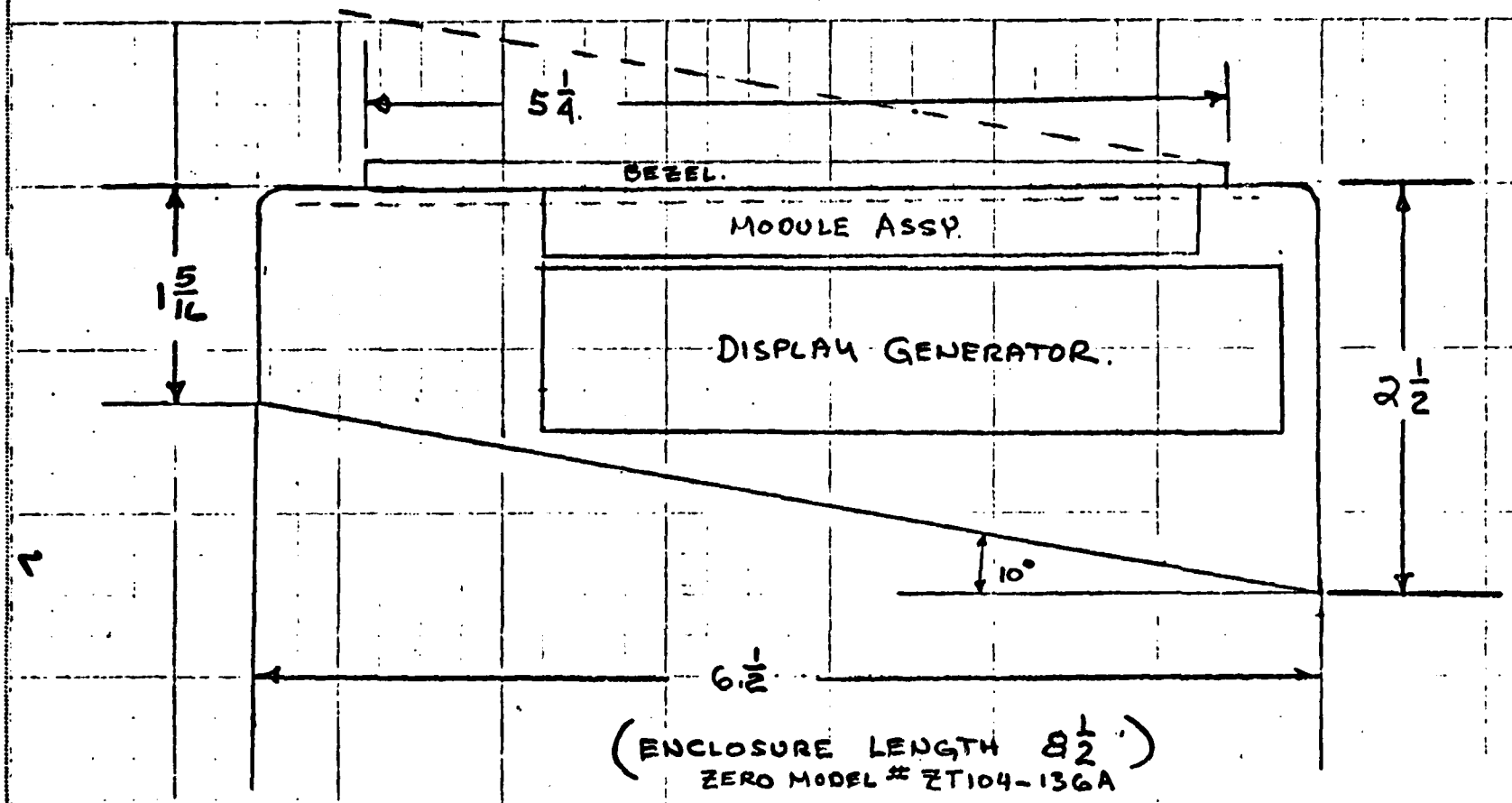
CUSTOMER DRAWING

DISPLAY ASSEMBLY

MECHANICAL DESIGN

BY..... DATE..... SUBJECT..... SHEET NO..... OF.....

CHKD. BY..... DATE..... JOB NO.....

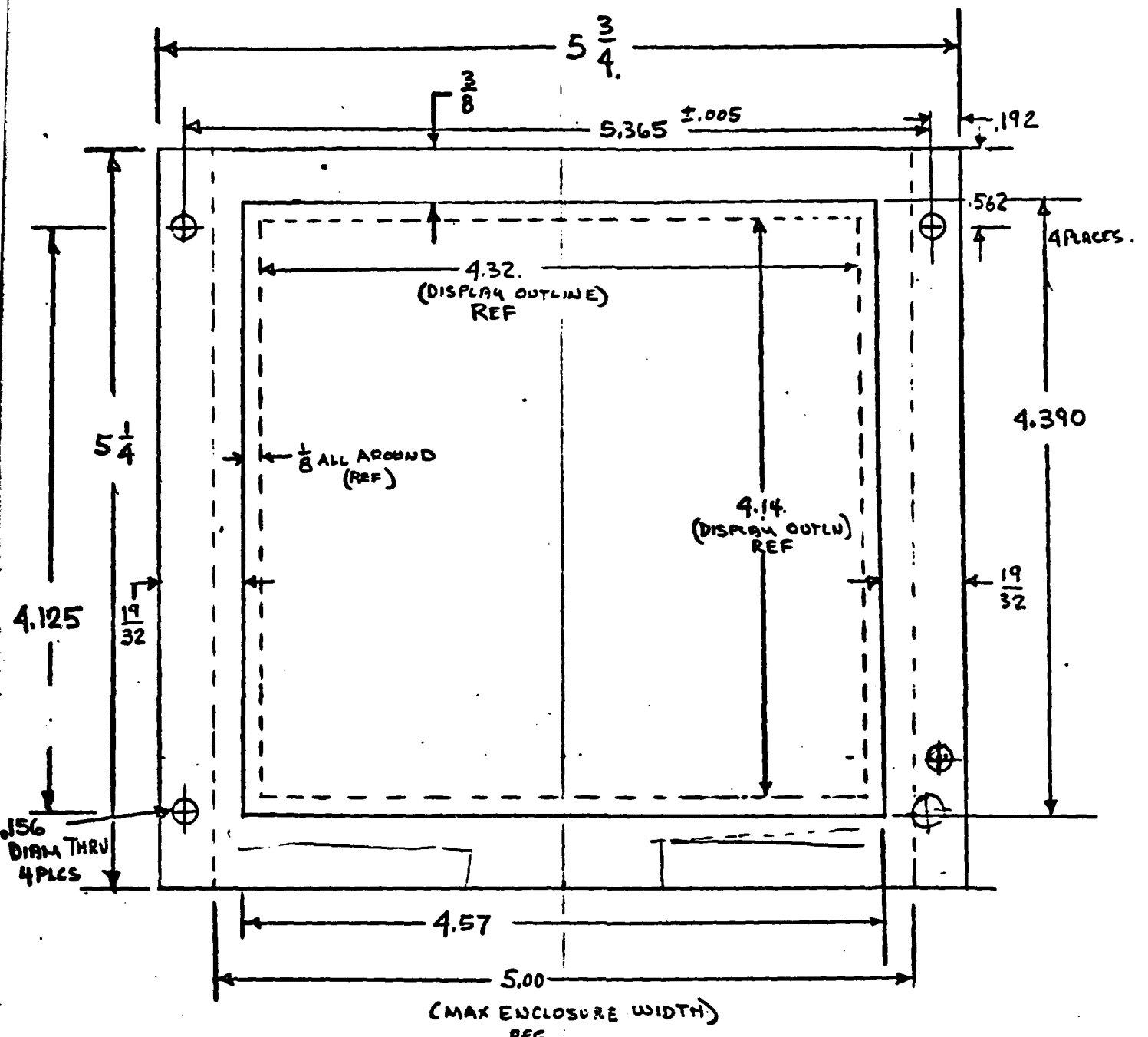


(ENCLOSURE LENGTH 8 1/2")

ZERO MODEL # ZT104-136A

DISPLAY ASSY LAYOUT.

ZAVATTO

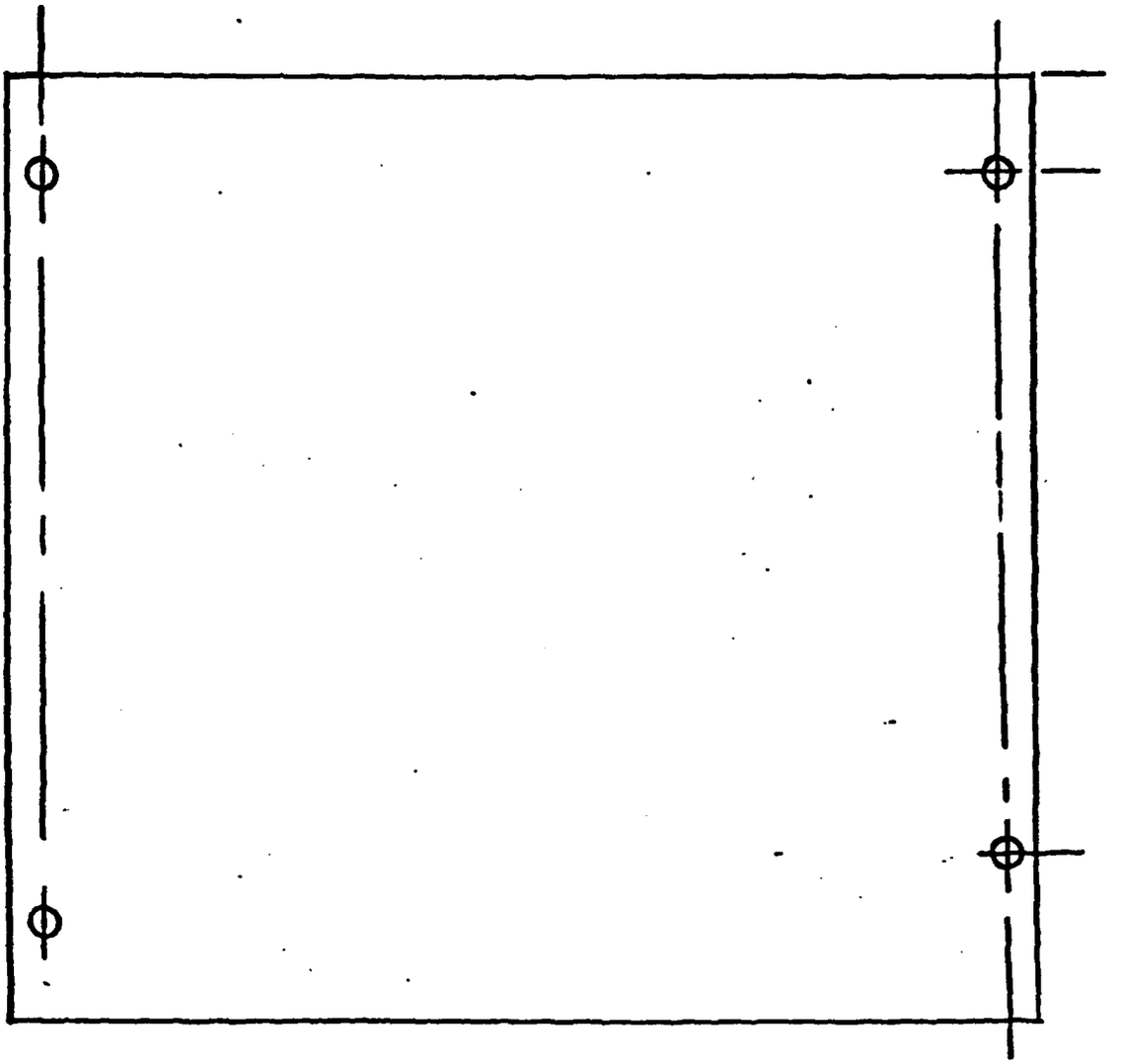


NOTES:

1. MTL: 1/16 24ST ALUM. WITH.
   BLK ANODIZE FINISH.
2. REMOVE SHARP EDGES & BURRS.

BEZEL FOR CDU.

25 APR 78. ZAVATTO



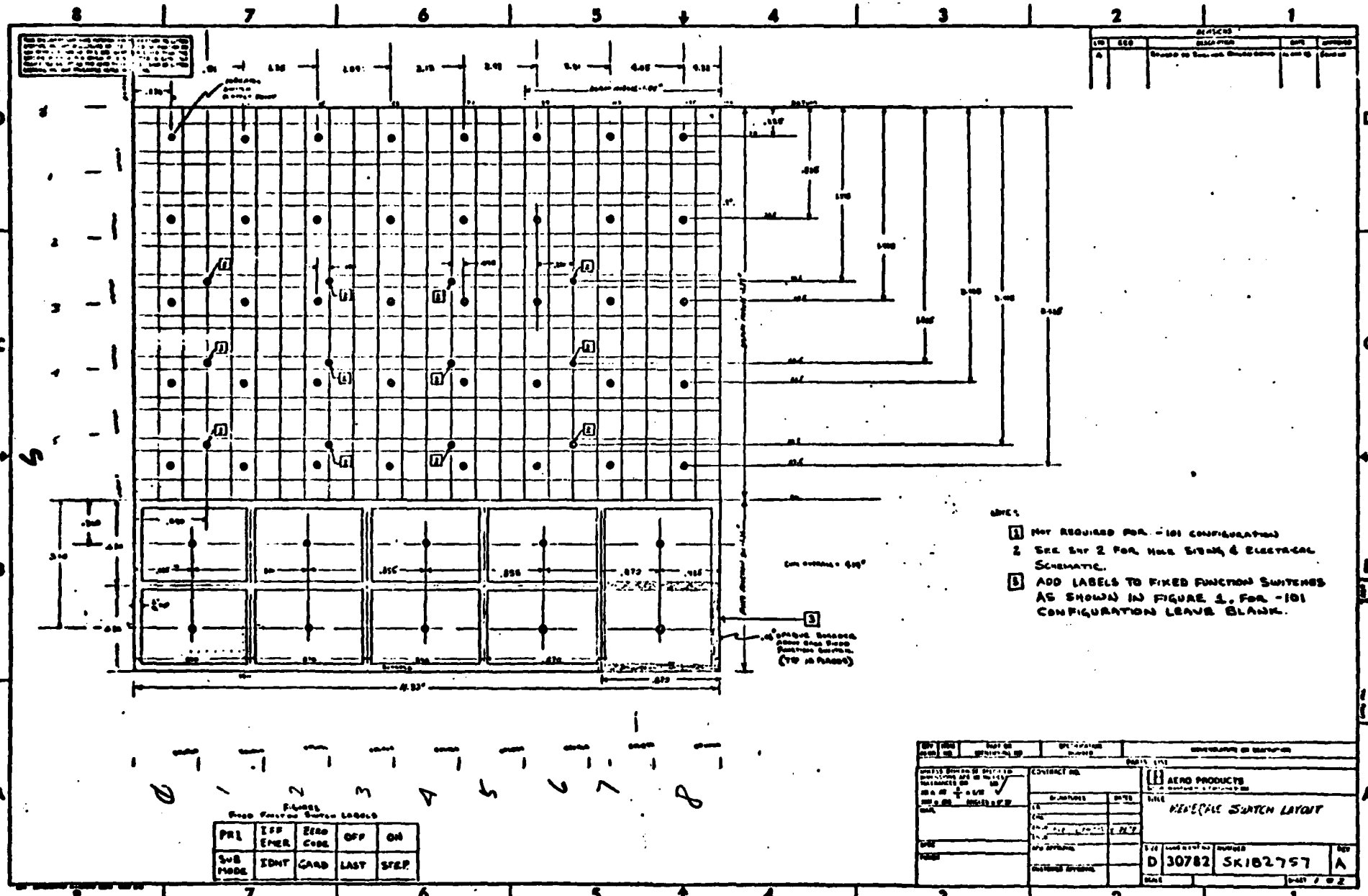
CLEAR PLASTIC MEMBRANE SWITCH SUPPORT.

$\frac{1}{8}$" OR $\frac{1}{16}$" CLEAR HOMALITE 911

11 BROOKSIDE DRIVE
WILMINGTON, DEL.
302-652-3686.
OR
DICK WEST. (213)-636-0377.

4

ZAVATTO.



NOTES:

1. NOT REQUIRED FOR -101 CONFIGURATION
2. SEE SHT 2 FOR HOLE SIZES & ELECTRICAL SCHEMATIC.
3. ADD LABELS TO FIXED FUNCTION SWITCHES AS SHOWN IN FIGURE 1. FOR -101 CONFIGURATION LEAVE BLANK.

FIGURE 1
FIXED FUNCTION SWITCH LABELS

PRI	ISF ENER	ZERO CODE	OFF	ON
SUB MODE	IDNT	GARD	LAST	STEP

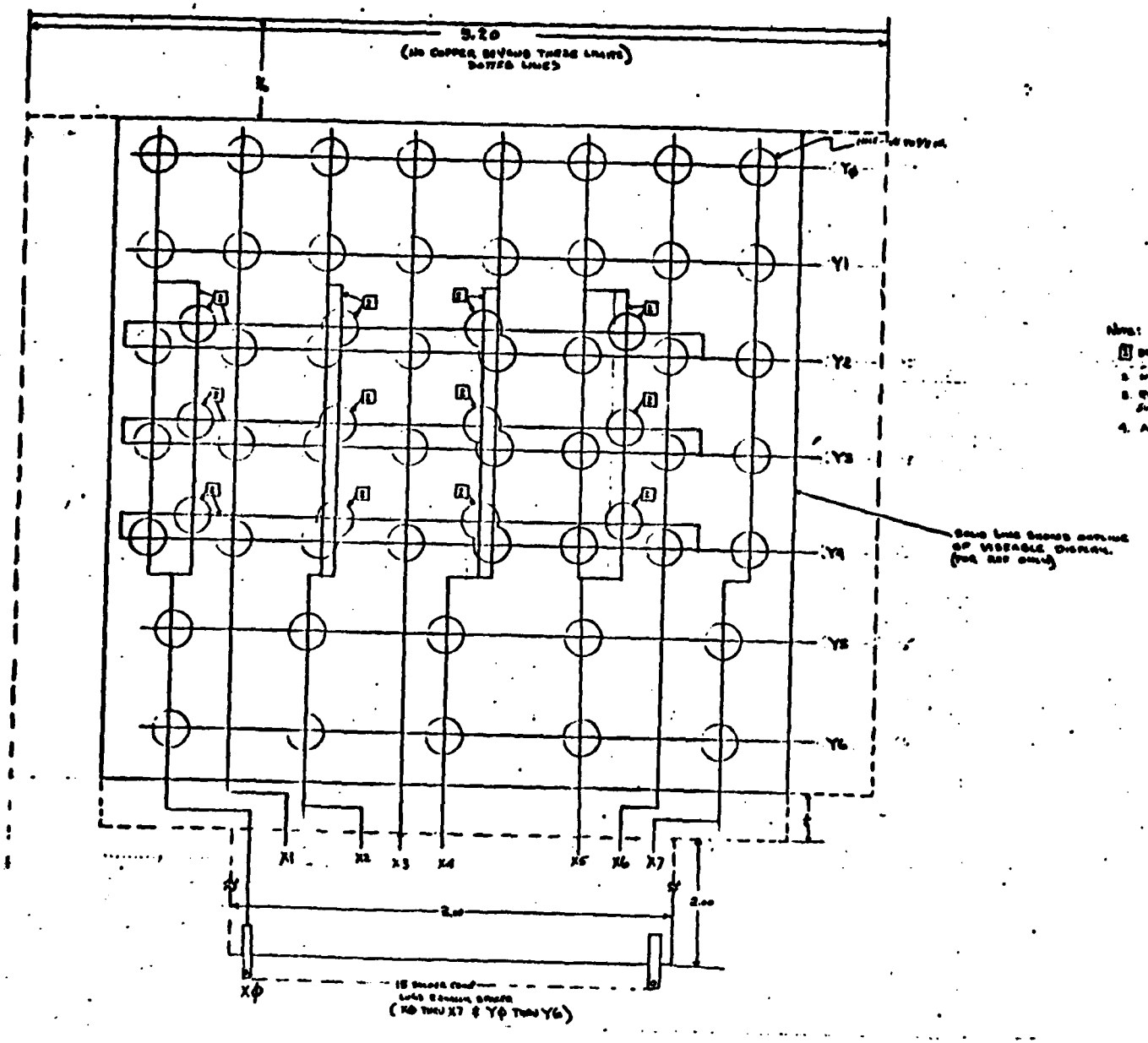
AERO PRODUCTS

TITLE: KEYSCALE SWITCH LAYOUT

D 30782 SK182757 A

SCALE

SHEET 1 OF 2



Note:

1. SOLDER [1] ON BOTH SIDES.
2. SHOWS DIODES POLARITY RELATIONSHIP TO JUMPERS.
3. RETURN ALL SYSTEMS CONNECTIONS TO BOTTOM OF SWITCH ASSEMBLY.
4. ALL TERMINATIONS FROM BOTTOM.

MEMORIAL SWITCH LAYOUT
SK182757

POWER

SYSTEM

BILL OF

MATERIALS

LITTON AERO PRODUCTS
21050 Burbank Boulevard, Woodland Hills, California 91364

CHG LTR	CHG LTR

ADVANCE BILL OF MATERIAL

ABM NO. FRONT PANEL A1 ECOM CD1A

SHEET 1 OF 1

LINE NO.	(D) LITTON DWG (M) MILITARY (S) LITTON SPEC (C) MFG NO. PART NUMBER	PART NAME OR DESCRIPTION	MANUFACTURER	QTY PER ASSY.	CHG LTR	FOR PLANNING USE
1		DISPLAY MODULE	LITTON DSD	3		
2		MEMBRANE SW. ASSY	LITTON DSD	1		
3		CONNECTOR, 50-PIN				
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						

Litton AERO PRODUCTS
21050 Bu... Boulevard, Woodland Hills, California 91364

CHG LTR	CHG LTR

ADVANCE BILL OF MATERIAL

DISPLAY CONTROLLER CARD #2
ABM NO. ECOM CDU

SHEET 1 OF 1

LINE NO.	(D) LITTON DWG (S) LITTON SPEC (M) MILITARY (C) MFG NO. PART NUMBER	PART NAME OR DESCRIPTION	MANUFACTURER	QTY PER ASSY.	CHG LTR	FOR PLANNING USE
1	54LS163	SYNC. COUNTER (Z1-Z4)		4		16-PIN
2	54LS151	1 OF 8 SELECTOR (Z5)		1		16-PIN
3	DM1L-2	1K X4 RAM (Z6-Z11)		6		16-PIN
4	54LS368A	HEX BUS DRIVER (Z12, Z13)		2		16-PIN
5	DS78L12	T²L TO CMOS INVERTER (Z14-Z19)		4		14-PIN
6	[illegible]	TRIPLE 3-INPUT NAND (Z14)		1		14-PIN
7	54L00	QUAD 2-INPUT NAND (Z19-Z21)		3		14-PIN
8	54LS08	QUAD 2-INPUT AND (Z22, Z23)		2		14-PIN
9	54LS02	QUAD 2-INPUT NOR (Z24, Z26, Z27)		1		14-PIN
10	54LS04	HEX INVERTER (Z25)		1		14-PIN
11	54LS107	MASTER-SLAVE F/F (Z28)		1		14-PIN
12						
13						
14						
15						
16						
17						
18						
19						

Litton AEP PRODUCTS
21030 B... Boulevard, Woodland Hills, California 91364

CHG LTR	CHG LTR

ADVANCE BILL OF MATERIAL

ABM NO. CPU CHASSIS A3, ECOM COU

SHEET 1 OF 1

LINE NO.	(D) LITTON DWG (S) LITTON SPEC (M) MILITARY (C) MFG NO. PART NUMBER	PART NAME OR DESCRIPTION	MANUFACTURER	QTY PER ASSY.	CHG LTR	FOR PLANNING USE
1	8085	CPU (Z1)	INTEL	1		40-PIN
2	8257	DMA CONTROLLER (Z2)	INTEL	1		40-PIN
3	8212	8-BIT I/O PORT (Z3, Z7, Z9, Z10)		4		24-PIN
4	74S258	SELECTOR (Z4)		1		16-PIN
5	8259	INTERRUPT CONTROLLER (Z5)		1		28-PIN
6	8253	TIMER (Z6)		1		24-PIN
7	54LS245	TRI-STATE BUFFER (Z8)		1		20-PIN
8	54LS74	D-TYPE F/F (Z11)		1		14-PIN
9	54LS02	2-INPUT NAND (Z12, Z13)		2		14-PIN
10		CRYSTAL.				
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

LITTON PRODUCTS
21050 Burbank Boulevard, Woodland Hills, California 91364

CHG LTR	CHG LTR

ADVANCE BILL OF MATERIAL

MEMORY CARD 1,2
ADM NO. [illegible] CBU

SHEET 1 OF 1

LINE NO.	(D) LITTON DWG (S) LITTON SPEC (M) MILITARY (C) MFG NO. PART NUMBER	PART NAME OR DESCRIPTION	MANUFACTURER	QTY PER ASSY.	CHG LTR	FOR PLANNING USE
1	2716	2K x 8 UVE ROM (Z1-Z4)		4		24-PIN
2	2114L	1K x 4 RAM (Z5-Z12)		8		18-PIN
3	54LS138	DECODER-3TO8 (Z13,Z14)		2		16-PIN
4						
5						
6						
7						
8						
9						
10						
11						
12						
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14						
15						
16						
17						
18						
19						

Litton AER[illegible]ODUCTS
21050 Bo[illegible]oulevard, Woodland Hills, California 91364

CHG LTR	CHG LTR

ADV[illegible]NCE BILL OF MATERIAL

ABM NO. I/O CARDS, ECOM CDU

SHEET 1 OF 1

LINE NO.	(D) LITTON DWG (S) LITTON SPEC (M) MILITARY (C) MFG NO. PART NUMBER	PART NAME OR DESCRIPTION	MANUFACTURER	QTY PER ASSY.	CHG LTR	FOR PLANNING USE
1	54LS138			1		16-PIN
2	8255			2		40-PIN
3						
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I/O CARD A5

CHIP	QTY	POWER REQUIREMENTS PER CHIP 5V	POWER REQUIREMENTS TOTALS 5V
54LS138	1	6.8	6.8
8255	2	120	240
TOTAL CURRENT (mA)			247
TOTAL POWER (WATTS)			1.2

MEMORY CARD A4

POWER REQUIREMENTS

CHIP	QTY	5V PER CHIP	5V TOTALS
2716	4	40	160
2114L	8	80	640
54LS138	2	6.3	12.6
TOTAL CURRENT (mA)			813
POWER (WATTS)			4.07

CPU-A3

CHIP	QTY	POWER REQUIREMENTS PER CHIP (MA) 5V	TOTALS (MA) 5V
8085	1	170	170
8257	1	120	120
8212	4	90	360
74LS258	1	12	12
8259	1	85	85
8253	1	104	104
74LS245	1	64	64
54LS74	1	40	40
54LS02	2	28	56
TOTAL CURRENT (MA)			822
TOTAL POWER (WATTS)			4.1

DISPLAY CONTROLLER A2

POWER REQUIREMENTS

CHIP	QTY	PER CHIP (MA) 5V	PER CHIP (MA) 8V	TOTALS (MA) 5V	TOTALS (MA) 8V
54LS'163	4	19		76	
54LS'151	1	6.0		6	
P2114L-2	6	90		540	
54LS'367	2	12		24	
DS75L12 }	3		6.0		18
DS78L12 }	1	6.0		6.0	
54LS'10	1	1.8		1.8	
54LS'00	3	2.4		7.2	
54LS'08	2	4.4		8.8	
54LS'02	3	2.8		8.4	
54LS'04	1	3.6		3.6	
TOTAL CURRENT (MA)				682	18
POWER (WATTS)				3.4	.102

FRONT PANEL, AY

CHIP	QTY	POWER REQUIREMENTS PER CHIP (MA) +8V	TOTALS (MA) 8V
DISPLAY MODULE	3	750	2,250
TOTAL CURRENT (MA)			2,250
POWER (WATTS)			18.0

SECTION 2

SOFTWARE DESCRIPTION

29 OCTOBER 1979

```
ISIS-II LINKER V2.1 WAS INVOKED BY:
 LINK :F1:ABSMAI.OBJ,:F1:CDU.OBJ,:F1:INPUT.OBJ,:F1:ABSDIS.OBJ,:F1:COM.OBJ, &
     :F1:VHF.OBJ,:F1:UHF.OBJ,:F1:ADF.OBJ,:F1:CNV.OBJ,:F1:ABSHWI.OBJ, &
     :F1:IFF.OBJ, &
     :F1:FILBUF.OBJ,:F1:GRID.OBJ,:F1:CDUDAT.OBJ,:F1:FONTDA.OBJ &
      TO :F1:CDU.LNK &
     MAP PRINT(:F1:CDU.MAP)


LINK MAP FOR :F1:CDU.LNK(CDU)

SEGMENT INFORMATION:
  START   STOP LENGTH REL NAME

              31BFH  B  CODE
               3A2H  B  DATA
                7EH  B  STACK
    3H    18H   18H  A  ABSOLUTE
   20H    22H    3H  A  ABSOLUTE
   24H    26H    3H  A  ABSOLUTE

INPUT MODULES INCLUDED:
 :F1:ABSMAI.OBJ(MAIN)
 :F1:CDU.OBJ(CDU)
 :F1:INPUT.OBJ(IN)
 :F1:ABSDIS.OBJ(DISP)
 :F1:COM.OBJ(COM)
 :F1:VHF.OBJ(VHF)
 :F1:UHF.OBJ(UHF)
 :F1:ADF.OBJ(ADF)
 :F1:CNV.OBJ(CNV)
 :F1:ABSHWI.OBJ(HWIO)
 :F1:IFF.OBJ(IFF)
 :F1:FILBUF.OBJ(FIL)
 :F1:GRID.OBJ(GRID)
 :F1:CDUDAT.OBJ(DAT)-
 :F1:FONTDA.OBJ(FONTDA)

UNRESOLVED EXTERNAL NAMES:
@P0094
@P0014
@P0034
DNVTIMETOGO
@P0029
@P0090
@P0027
RMBUFB
@P0095
@P0023
@P0098
@P0104
@P0091
@P0105
@P0070
@P0028
RMBUFA
DISPLAYPRESENTPOSITION
DISPLAYACTIVEWAYPT
@P0089
INITDMV
DNVBEARING
DNVCURMODE
DNVRANGE
```

```
ISIS-II LINKER V2.1 WAS INVOKED BY:
 LINK :F1:CDU.LNK, &
      :F1:DNV.OBJ,:F1:DNV1.OBJ,:F1:DNV2.OBJ,:F1:DNV3.OBJ,:F1:DNV4.OBJ,&
      :F1:DNV5.OBJ,:F1:DNVDAT.OBJ, &
       PLM80.LIB,SYSTEM.LIB &
       TO :F1:DNV.LNK MAP PRINT(:F1:DNV.MAP)


LINK MAP FOR :F1:DNV.LNK(DNV)

SEGMENT INFORMATION:
  START   STOP LENGTH REL NAME

              482BH  B  CODE
               FC3H  B  DATA
                AEH  B  STACK
    3H    1AH   18H  A  ABSOLUTE
   20H    22H    3H  A  ABSOLUTE
   24H    26H    3H  A  ABSOLUTE

INPUT MODULES INCLUDED:
 :F1:CDU.LNK(CDU)
 :F1:DNV.OBJ(DNV)
 :F1:DNV1.OBJ(DNV1)
 :F1:DNV2.OBJ(DNV2)
 :F1:DNV3.OBJ(DNV3)
 :F1:DNV4.OBJ(DNV4)
 :F1:DNV5.OBJ(DNV5)
 :F1:DNVDAT.OBJ(DAT)
 PLM80.LIB(@P0014)
 PLM80.LIB(@P0022)
 PLM80.LIB(@P0025)
 PLM80.LIB(@P0029)
 PLM80.LIB(@P0034)
 PLM80.LIB(@P0048)
 PLM80.LIB(@P0069)
 PLM80.LIB(@P0084)
 PLM80.LIB(@P0089)
 PLM80.LIB(@P0091)
 PLM80.LIB(@P0094)
 PLM80.LIB(@P0098)
 PLM80.LIB(@P0103)
 PLM80.LIB(@P0105)
```

```
ISIS-II LOCATER V2.1 INVOKED BY:
- LOCATE :F1:DNV.LNK ORDER(CODE,STACK,DATA,MEMORY) &
**      CODE(28H) STACK(6000H) DATA(6030H) STACKSIZE(30H) &
**      RESTARTO &
**      PRINT(:F1:DNV.LOC) MAP

MEMORY MAP OF MODULE DNV
READ FROM FILE :F1:DNV.LNK
WRITTEN TO FILE :F1:DNV
MODULE START ADDRESS 0028H

START   STOP LENGTH REL NAME

   0H     2H     3H  A  ABSOLUTE
   3H    1AH    18H  A  ABSOLUTE
  20H    22H     3H  A  ABSOLUTE
  24H    26H     3H  A  ABSOLUTE
  28H  4852H  482BH  B  CODE
6000H  602FH    30H  B  STACK
6030H  6FF2H   FC3H  B  DATA
6FF3H  F6BFH  86CDH  B  MEMORY
```

```
DECLARE ROW0 LITERALLY '80H',
        ROW1 LITERALLY '81H',
        ROW2 LITERALLY '82H',
        ROW3 LITERALLY '83H',
        ROW4 LITERALLY '84H',
        ROW5 LITERALLY '85H',
        ROW6 LITERALLY '86H',
        ROW7 LITERALLY '87H',
        ROW8 LITERALLY '88H',

        COL1 LITERALLY '0A1H',
        COL2 LITERALLY '0A2H',
        COL3 LITERALLY '0A3H',
        COL4 LITERALLY '0A4H',
        COL5 LITERALLY '0A5H',
        COL6 LITERALLY '0A6H',
        COL7 LITERALLY '0A7H',
        COL8 LITERALLY '0A8H',
        COL9 LITERALLY '0A9H',
        COL10 LITERALLY '0AAH',
        COL11 LITERALLY '0ABH',
        COL12 LITERALLY '0ACH',
        COL13 LITERALLY '0ADH',
        COL14 LITERALLY '0AEH',
        COL15 LITERALLY '0AFH',
        COL16 LITERALLY '0B0H',
        COL17 LITERALLY '0B1H',
        COL18 LITERALLY '0B2H',
        COL19 LITERALLY '0B3H',
        COL20 LITERALLY '0B4H',
        COL21 LITERALLY '0B5H',
        COL22 LITERALLY '0B6H',
        COL23 LITERALLY '0B7H';

DECLARE TRUE LITERALLY '0FFH',
        FALSE LITERALLY '0',
        FOREVER LITERALLY 'WHILE 1',
        SWITCH LITERALLY '40H',
        CNTL$DIGIT LITERALLY '81H',
        NOCLEAR$CNTL$DIGIT LITERALLY '0C1H',
        NOCLEAR$DIGIT LITERALLY '41H',
        DIGIT LITERALLY '1',
        OCTAL LITERALLY '2',
        NORTH$SOUTH LITERALLY '3',
        EAST$WEST LITERALLY '4',
        DMV$ALPHA LITERALLY '5',
        CLEAR$SW LITERALLY '45Q',
        ENTER$SW LITERALLY '47Q',
        SQL$OFF$SW LITERALLY '40Q',
        OFF$SW LITERALLY '53Q',
        SUBMODE$SW LITERALLY '60Q',
        LAST$SW LITERALLY '63Q',
        STEP$SW LITERALLY '64Q',
        CKPT LITERALLY '0',
        TGT LITERALLY '1',
        BEG@SYM LITERALLY '22H';
```

```
ISIS-II PL/M-80 V3.0 COMPILATION OF MODULE MAIN
OBJECT MODULE PLACED IN :F1:ABSMAI.OBJ
COMPILER INVOKED BY:  PLM80 :F1:ABSMAI.SRC DATE(22DEC78)


           $TITLE('MAIN')
  1        MAIN: DO;
  2  1     DECLARE FOREVER LITERALLY 'WHILE 1';

  3  1     ADD$SWO: PROCEDURE(SWV) EXTERNAL;
  4  2     DECLARE SWV BYTE;
  5  2     END;
  6  1     INIT$HARDWARE: PROCEDURE EXTERNAL;
  7  2     END;
  8  1     INIT$CDU: PROCEDURE EXTERNAL;
  9  2     END;
 10  1     CDU: PROCEDURE EXTERNAL;
 11  2     END;
 12  1     PROCESS$SWITCH: PROCEDURE EXTERNAL;
 13  2     END;


 14  1       CALL INIT$HARDWARE;
 15  1       CALL INIT$CDU;
 16  1       DO FOREVER;
 17  2         CALL CDU;
 18  2         CALL PROCESS$SWITCH;
 19  2         END;

 20  1     END;   /* MAIN */


MODULE INFORMATION:

    CODE AREA SIZE     = 0014H     20D
    VARIABLE AREA SIZE = 0000H      0D
    MAXIMUM STACK SIZE = 0002H      2D
    25 LINES READ
    0 PROGRAM ERROR(S)

END OF PL/M-80 COMPILATION
```

```
ISIS-II PL/M-80 V3.1 COMPILATION OF MODULE CDU
OBJECT MODULE PLACED IN :F1:CDU.OBJ
COMPILER INVOKED BY:  PLM80 :F1:CDU.SRC DATE(27OCT79) DEBUG


                $TITLE('CDU')
                 /* CLEAR, INIT$CDU, SUSPEND, RESTART, LIMIT$TEST */
      1          CDU: DO;
                $NOLIST INCLUDE(:F1:CDULIT.SRC)
      4  1       DECLARE HORZ LITERALLY '0FEH',
                    VERT LITERALLY '0FDH';

      5  1       READ: PROCEDURE(ICB$PTR) EXTERNAL;
      6  2       DECLARE ICB$PTR ADDRESS;
      7  2       END;
      8  1       CLEAR: PROCEDURE(ROW) EXTERNAL;
      9  2       DECLARE ROW BYTE;
     10  2       END;
     11  1       INSERT: PROCEDURE(NCHAR,SOURCE$PTR,DEST$PTR,DELM$CH,DELM$MASK) EXTERNAL;
     12  2       DECLARE (NCHAR,DELM$CH) BYTE, (SOURCE$PTR,DEST$PTR,DELM$MASK) ADDRESS;
     13  2       END;
     14  1       UPDATE$LINE: PROCEDURE(ROW,COL,NUM$CH,PTR) EXTERNAL;
     15  2       DECLARE (ROW,COL,NUM$CH) BYTE, PTR ADDRESS;
     16  2       END;
     17  1       DISPLAY: PROCEDURE(ICB$PTR) EXTERNAL;
     18  2       DECLARE ICB$PTR ADDRESS;
     19  2       END;
     20  1       GRID: PROCEDURE(PTR) EXTERNAL;
     21  2       DECLARE PTR ADDRESS;
     22  2       END;
     23  1       UPDATE$SCREEN: PROCEDURE EXTERNAL;
     24  2       END;
     25  1       INITIALIZE$SWO: PROCEDURE EXTERNAL;
     26  2       END;
     27  1       SCREEN$INTENSITY: PROCEDURE(LEVEL) EXTERNAL;
     28  2       DECLARE LEVEL BYTE;
     29  2       END;
     30  1       CLEAR$LINE: PROCEDURE(LINE$NUM) EXTERNAL;
     31  2       DECLARE LINE$NUM BYTE;
     32  2       END;
     33  1       INIT$VHF: PROCEDURE EXTERNAL;
     34  2       END;
     35  1       INIT$UHF: PROCEDURE EXTERNAL;
     36  2       END;
     37  1       INIT$ADF: PROCEDURE EXTERNAL;
     38  2       END;
     39  1       INIT$CNV: PROCEDURE EXTERNAL;
     40  2       END;
     41  1       INIT$IFF: PROCEDURE EXTERNAL;
     42  2       END;
     43  1       INIT$DNV: PROCEDURE EXTERNAL;
     44  2       END;
     45  1       VHF$SUBMODE: PROCEDURE EXTERNAL;
     46  2       END;
     47  1       DNV$SUBMODE: PROCEDURE EXTERNAL;
     48  2       END;
```

```
 49  1      UHF$SUBMODE: PROCEDURE EXTERNAL;
 50  2      END;
 51  1      IFF$SUBMODE: PROCEDURE EXTERNAL;
 52  2      END;
 53  1      ADF$SUBMODE: PROCEDURE EXTERNAL;
 54  2      END;
 55  1      CNV$SUBMODE: PROCEDURE EXTERNAL;
 56  2      END;
 57  1      DISPLAY$ACTIVE$WAYPT: PROCEDURE EXTERNAL;
 58  2      END;
 59  1      DISPLAY$PRESENT$POSITION: PROCEDURE(ROW) EXTERNAL;
 60  2      DECLARE ROW BYTE;
 61  2      END;

             /* EXTERNAL VARIABLES */
 62  1      DECLARE
               CURRENT$DISP(9) STRUCTURE(CHAR(24) BYTE) EXTERNAL,
               SW$INDEX BYTE EXTERNAL,
               SW BYTE EXTERNAL,
               VHF$STATUS BYTE EXTERNAL,
               VHF$ACTIVE$CHAN BYTE EXTERNAL,
               VHF$FREQ(10) STRUCTURE(DIGITS(4) BYTE) EXTERNAL,
               UHF$STATUS BYTE EXTERNAL,
               UHF$ACTIVE$CHAN BYTE EXTERNAL,
               UHF$FREQ(10) STRUCTURE(DIGITS(6) BYTE) EXTERNAL,
               ADF$STATUS BYTE EXTERNAL,
               ADF$ACTIVE$CHAN BYTE EXTERNAL,
               ADF$FREQ(10) STRUCTURE(DIGITS(4) BYTE) EXTERNAL,
               CNV$STATUS BYTE EXTERNAL,
               CNV$ACTIVE$CHAN BYTE EXTERNAL,
               CNV$FREQ(10) STRUCTURE(DIGITS(5) BYTE) EXTERNAL,
               IFF$STATUS BYTE EXTERNAL,
               IFF$M4$MODE BYTE EXTERNAL,
               DNV$STATUS BYTE EXTERNAL,
               DNV$RANGE BYTE EXTERNAL,
               DNV$BEARING BYTE EXTERNAL,
               DNV$TIME$TO$GO BYTE EXTERNAL;

 63  1      DECLARE OFF$ON$TEXT(6) BYTE PUBLIC DATA('OFFON ');
 64  1      DECLARE TEMP$BUF(24) BYTE PUBLIC;

             /* BLANK$LINE PLACED IN LOW CORE TO SAVE A FEW BYTES OF PROM */
 65  1      DECLARE BLANK$LINE(24) BYTE PUBLIC AT(3)
               DATA('                        ');

 66  1      CLEAR$TEMP$BUF: PROCEDURE PUBLIC;
 67  2        CALL MOVE(24,.BLANK$LINE,.TEMP$BUF);
 68  2      END;
 69  1      DECLARE PRI$ENABLE$LIST STRUCTURE(
               SW$MASK(7) BYTE,
               SW$VALUE(4) BYTE) DATA(
               88H,80H,80H,88H,0,18H,0,
               01H,23H,45H,66H);
 70  1      DECLARE PRI$ICB STRUCTURE(
               MODE BYTE,
               NUM$CH BYTE,
               DEL$$CH BYTE,
```

```
                DELM$MASK ADDRESS,
                ECHO$ROW BYTE,
                ECHO$COL BYTE,
                SW$ENABLE ADDRESS) DATA(SWITCH,0,0,0,0,0,.PRI$ENABLE$LIST);

 71  1      DECLARE PRI$TABLEAU(*) BYTE DATA(
                ROW0,'FM ',COL12,'CNV',
                ROW1,COL13,'RGE',COL23,'M',
                ROW2,'UHF',COL13,'BCR',
                ROW3,COL13,'TTG',COL23,'M',
                ROW4,'ADF',
                ROW6,'CNV',COL12,'IFF',0);

 72  1      DECLARE DIGIT$KB$GRID(*) BYTE PUBLIC DATA(
                HORZ,0,104,22,32,
                HORZ,2,104,52,72,92,
                HORZ,92,104,42,62,82,
                HORZ,110,122,22,32,42,52,62,72,82,92,
                HORZ,128,140,22,32,42,52,62,72,82,92,
                VERT,32,92,2,32,62,92,
                VERT,22,32,92,104,110,122,128,140,
                VERT,42,52,104,110,122,128,140,
                VERT,62,72,104,110,122,128,140,
                VERT,82,92,104,110,122,128,140,0FFH);
 73  1      DECLARE SUBMODE$GRID(*) BYTE PUBLIC DATA(
                HORZ,0,143,22,32,
                HORZ,2,122,52,72,92,
                VERT,32,92,2,32,62,92,122,0FFH);

 74  1      DECLARE DIGIT$KB$TABLEAU(*) BYTE PUBLIC DATA(
                ROW2,COL16,'1',COL19,'2',COL22,'3',
                ROW4,COL16,'4',COL19,'5',COL22,'6',
                ROW6,COL16,'7',COL19,'8',COL22,'9',
                ROW8,COL16,'C',COL19,'0',COL22,'E',0);
 75  1      DECLARE OCTAL$KB$TABLEAU(*) BYTE PUBLIC DATA(
                ROW2,COL16,'1',COL19,'2',COL22,'3',
                ROW4,COL16,'4',COL19,'5',COL22,'6',
                ROW6,COL16,'7',
                ROW8,COL16,'C',COL19,'0',COL22,'E',0);


 76  1      DISPLAY$DIGIT$KB: PROCEDURE PUBLIC;

 77  2         CALL GRID(.DIGIT$KB$GRID);
 78  2         CALL DISPLAY(.DIGIT$KB$TABLEAU);
 79  2      END;
```

```
                $EJECT
 80   1         DECLARE CDU$STACK(40) ADDRESS,
                   CDU$SPV ADDRESS,
                   SYS$SPV ADDRESS;

 81   1         INIT$CDU: PROCEDURE PUBLIC;

 82   2           DISABLE;
 83   2           CDU$STACK(LENGTH(CDU$STACK)-1) = .CDU$TOP;
 84   2           CDU$SPV = .CDU$STACK(LENGTH(CDU$STACK)-1);
 85   2           CALL INITIALIZE$SWI;
 86   2           CALL INIT$VHF;
 87   2           CALL INIT$UHF;
 88   2           CALL INIT$ADF;
 89   2           CALL INIT$CNV;
 90   2           CALL INIT$IFF;
 91   2           CALL INIT$INV;
 92   2           ENABLE;
 93   2         END;   /* OF INIT$CDU */

 94   1         SUSPEND: PROCEDURE PUBLIC;

 95   2           DISABLE;
 96   2           CDU$SPV = STACKPTR;
 97   2           STACKPTR = SYS$SPV;
 98   2           ENABLE;
 99   2         END;

100   1         RESTART: PROCEDURE PUBLIC;

101   2           DISABLE;
102   2           CDU$STACK(LENGTH(CDU$STACK) - 1) = .CDU$TOP;
103   2           CDU$SPV = .CDU$STACK(LENGTH(CDU$STACK)-1);
104   2           STACKPTR = SYS$SPV;
105   2           ENABLE;
106   2         END;
```

```
                $EJECT
107   1         ERROR: PROCEDURE(CODE) PUBLIC;
108   2         DECLARE CODE BYTE;

109   2         DECLARE STEP$ENABLE STRUCTURE(
                    SW$MASK(7) BYTE,
                    SW$VALUE(1) BYTE) DATA(
                    0,0,0,0,4,0,0,  /* CLEAR$SW */
                    00H);
110   2         DECLARE ERROR$ICB STRUCTURE(
                    MODE BYTE,
                    NUM$CH BYTE,
                    DELIM$CH BYTE,
                    DELIM$MASK ADDRESS,
                    ECHO$ROW BYTE,
                    ECHO$COL BYTE,
                    SW$ENABLE ADDRESS) DATA(SWITCH,0,0,0,0,0,.STEP$ENABLE);
111   2         DECLARE MSG0(*) BYTE DATA(ROW2,'INVALID ENTRY',0),
                    MSG1(*) BYTE DATA(ROW2,'NO UNALLOCATED TARGETS',0),
                    MSG2(*) BYTE DATA(ROW2,'NO DATA FOR THIS CKPT',0);
112   2         DECLARE MSG$ADD(3) ADDRESS DATA(.MSG0,.MSG1,.MSG2);

113   2            CALL MOVE(24,.CURRENT$DISP(2),.TEMP$BUF);   /*SAVE CURRENT DISPLAY ROW 2 */
114   2            CALL CLEAR$LINE(2);
115   2            CALL DISPLAY(MSG$ADD(CODE));
116   2            CALL READ(.ERROR$ICB);
117   2            CALL CLEAR$LINE(2);
118   2            CALL UPDATE$LINE(2,0,24,.TEMP$BUF); /* RESTORE DISPLAY ROW 2 */
119   2         END;   /* OF ERROR */
```

```
                $EJECT
120   1         LIMIT$TEST: PROCEDURE(BUF$PTR,NUM$DIGITS,MIN$PTR,MAX$PTR) BYTE PUBLIC;
                /* THIS PROCEDURE PERFORMS A LEXICOGRAPHICAL COMPARISON OF A TEXT
                   STRING WITH TWO OTHER STRINGS TO DETERMINE IF THE UNKNOWN STRING
                   IS WIHTIN THE BOUNDS SPECIFIED BY THE OTHER TWO.
                   THE DIGITS ARE EXAMINED FROM LEFT TO RIGHT.
                   IT WAS WRITTEN TO COMPARE ASCII DIGIT STRINGS WITH MAX AND MIN STRINGS.
                   A VALUE OF 1 IS RETURNED IF:
                        MIN$STRING <= STRING <= MAX$STRING
                   AND A VALUE OF 0 OTHERWISE. */
121   2           DECLARE NUM$DIGITS BYTE,
                     (BUF$PTR,MIN$PTR,MAX$PTR) ADDRESS;
122   2           DECLARE (N,I) BYTE,
                     (BUF BASED BUF$PTR)(1) BYTE,
                     (MIN BASED MIN$PTR)(1) BYTE,
                     (MAX BASED MAX$PTR)(1) BYTE;

123   2             IF (BUF(0) < MIN(0)) OR (BUF(0) > MAX(0)) THEN RETURN 0; /* FAIL */
125   2             IF NUM$DIGITS > 2 THEN N = NUM$DIGITS - 2;
127   2                               ELSE N = 0;
128   2             DO I = 0 TO N;
129   3               IF MIN(I) <> MAX(I) THEN DO;
131   4                 IF (MIN(I) < BUF(I)) AND (BUF(I) < MAX(I)) THEN RETURN 1; /* OK */
133   4                 IF BUF(I) = MIN(I) THEN DO;
135   5                   IF BUF(I+1) < MIN(I+1) THEN RETURN 0; /* FAIL */
137   5                   IF BUF(I+1) > MIN(I+1) THEN RETURN 1; /* OK */
139   5                   END;
140   4                 ELSE DO;
141   5                   IF BUF(I) = MAX(I) THEN DO;
143   6                     IF BUF(I+1) > MAX(I+1) THEN RETURN 0;   /* FAIL */
145   6                     IF BUF(I+1) < MAX(I+1) THEN RETURN 1;   /* OK */
147   6                     END;
148   5                   END;  /* OF ELSE DO */
149   4                 END;    /* OF IF MIN(I) <> MAX(I) THEN DO */
150   3               ELSE DO;
151   4                 IF BUF(I) <> MIN(I) THEN RETURN 0;  /* FAIL */
153   4                 IF (BUF(I+1) < MIN(I+1)) OR (BUF(I+1) > MAX(I+1))
                            THEN RETURN 0;    /* FAIL */
155   4                 END;
156   3               END;  /* OF DO I */
157   2             RETURN 1;   /* OK */

158   2           END;  /* OF LIMIT$TEST */
```

```
                $EJECT
159   1         DISPLAY$CDU$STATUS: PROCEDURE;

160   2         FORMAT$FREQ:PROCEDURE(CHAN,STATUS,FREQ$PTR,NDIGITS,ROW,COL,MASK);
161   3         DECLARE (CHAN,STATUS,NDIGITS,ROW,COL) BYTE,
                     (FREQ$PTR,MASK) ADDRESS;

162   3            CALL CLEAR$TEMP$BUF;
163   3            IF (STATUS AND 20H) > 0 THEN TEMP$BUF(0) = '*';
165   3            CALL INSERT(NDIGITS,FREQ$PTR+CHAN*NDIGITS,.TEMP$BUF(1),'.',MASK);
166   3            CALL UPDATE$LINE(ROW,COL,NDIGITS+2,.TEMP$BUF);
167   3         END;


168   2            CALL FORMAT$FREQ(VHF$ACTIVE$CHAN,VHF$STATUS,.VHF$FREQ,4,0,3,2000H);
169   2            CALL FORMAT$FREQ(UHF$ACTIVE$CHAN,UHF$STATUS,.UHF$FREQ,6,2,3,1000H);
170   2            CALL FORMAT$FREQ(ADF$ACTIVE$CHAN,ADF$STATUS,.ADF$FREQ,4,4,3,0);
171   2            CALL FORMAT$FREQ(CNV$ACTIVE$CHAN,CNV$STATUS,.CNV$FREQ,5,6,3,1000H);

                /* DISPLAY IFF STATUS LINE */
172   2            CALL CLEAR$TEMP$BUF;
173   2            IF (IFF$STATUS AND 20H) > 0 THEN TEMP$BUF(0) = '*';
175   2            IF IFF$STATUS THEN TEMP$BUF(1) = '1';
177   2            IF (IFF$STATUS AND 2) > 0 THEN TEMP$BUF(2) = '2';
179   2            IF (IFF$STATUS AND 4) > 0 THEN DO;
181   3              TEMP$BUF(3) = '3';
182   3              TEMP$BUF(4) = 'A';
183   3              END;
184   2            IF (IFF$STATUS AND 10H) > 0 THEN TEMP$BUF(5) = 'C';
186   2            IF (IFF$STATUS AND 8) > 0 THEN DO;
188   3              TEMP$BUF(6) = '4';
189   3              IF IFF$M4$MODE THEN TEMP$BUF(7) = 'B';
191   3                             ELSE TEMP$BUF(7) =  A';
192   3              END;
193   2            CALL UPDATE$LINE(6,15,8,.TEMP$BUF);

                /* DISPLAY DNV STATUS */
194   2            CALL DISPLAY$ACTIVE$WAYPT;
195   2            IF SHR(DNV$STATUS,4) THEN CALL UPDATE$LINE(0,15,1,.('*'));
197   2            CALL INSERT(4,.DNV$RANGE,.TEMP$BUF,'.',1000H);
198   2            CALL UPDATE$LINE(1,17,5,.TEMP$BUF);
199   2            CALL UPDATE$LINE(2,19,3,.DNV$BEARING);
200   2            CALL UPDATE$LINE(3,19,3,.DNV$TIME$TO$GO);
201   2            CALL DISPLAY$PRESENT$POSITION(8);
202   2         END;   /* OF DISPLAY$CDU$STATUS */
```

```
                $EJECT
203   1         CDU$ON$OFF: PROCEDURE;

204   2           IF SW = OFF$SW THEN CALL SCREEN$INTENSITY(0);
206   2                          ELSE CALL SCREEN$INTENSITY(50H);
207   2         END;


208   1         CDU: PROCEDURE PUBLIC;

209   2           DISABLE;
210   2           SYS$SPV = STACKPTR;
211   2           STACKPTR = CDU$SPV;
212   2           ENABLE;
213   2         END;

214   1         CDU$TOP: PROCEDURE;

                /* GENERATE PRIMARY TABLEAU */
215   2           CALL CLEAR(0);
216   2           CALL DISPLAY(.PRI$TABLEAU);
217   2           CALL DISPLAY$CDU$STATUS;
218   2           CALL READ(.PRI$ICB);
219   2           DO CASE SW$INDEX;
220   3             CALL VHF$SUBMODE;
221   3             CALL DMV$SUBMODE;
222   3             CALL UHF$SUBMODE;
223   3             CALL ADF$SUBMODE;
224   3             CALL CNV$SUBMODE;
225   3             CALL IFF$SUBMODE;
226   3             CALL CDU$ON$OFF;
227   3             END;  /* OF DO CASE */

                /* TERMINATE CDU PROCESSING */
228   2           DISABLE;
229   2           CDU$STACK(LENGTH(CDU$STACK)-1) = .CDU$TOP;
230   2           CDU$SPV = .CDU$STACK(LENGTH(CDU$STACK)-1);
231   2           STACKPTR = SYS$SPV;
232   2           ENABLE;
233   2         END;   /* OF CDU$TOP */

234   1         END;   /* OF CDU: DO */


MODULE INFORMATION:

     CODE AREA SIZE     = 0618H   1560D
     VARIABLE AREA SIZE = 007FH    127D
     MAXIMUM STACK SIZE = 000EH     14D
     408 LINES READ
     0 PROGRAM ERROR(S)

END OF PL/M-80 COMPILATION
```

```
ISIS-II PL/M-80 V3.0 COMPILATION OF MODULE IN
OBJECT MODULE PLACED IN :F1:INPUT.OBJ
COMPILER INVOKED BY:  PLM80 :F1:INPUT.SRC DATE(21JUNE79) DEBUG


                $TITLE('INPUT')
  1             IN: DO;
                $NOLIST INCLUDE(:F1:CONLIT.SRC)
  4  1          DECLARE PRIMARY$SW LITERALLY '500';

  5  1          SUSPEND: PROCEDURE EXTERNAL;
  6  2          END;
  7  1          RESTART: PROCEDURE EXTERNAL;
  8  2          END;
  9  1          UPDATE$SCREEN: PROCEDURE EXTERNAL;
 10  2          END;
 11  1          UPDATE$LINE: PROCEDURE(ROW,COL,NCHAR,TEXT$PTR) EXTERNAL;
 12  2          DECLARE (ROW,COL,NCHAR) BYTE, TEXT$PTR ADDRESS;
 13  2          END;

 14  1          DECLARE ICB$PTR ADDRESS,
                   ICB BASED ICB$PTR STRUCTURE(
                   MODE BYTE,  /* INPUT MODE */
                   NUM$CH BYTE,    /*NUMBER OF CHS TO BE INPUT */
                   DELM$CH BYTE,   /* DELIMETER CHARACTER */
                   DELM$MASK ADDRESS,  /* DELIMETER MASK */
                   ECHO$ROW BYTE,
                   ECHO$COL BYTE,
                   SW$ENABLE$PTR ADDRESS);

                /* MISCELLANEOUS VARIABLES */
 15  1          DECLARE
                   IN$MODE BYTE,
                   INPUT$ENABLE BYTE,
                   FIELD$SIZE BYTE,
                   DISP$LOC BYTE,
                   DISP$MASK ADDRESS,
                   IN$DELM$MASK ADDRESS,
                   CH$COUNT BYTE,
                   DISP$BUF(16) BYTE,
                   CLEAR$STATE BYTE;

                /* GLOBAL VARIABLES */
 16  1          DECLARE
                   IN$BUF(16) BYTE PUBLIC,
                   DATA$ENTERED BYTE PUBLIC,
                   SW$INDEX BYTE PUBLIC,
                   SW BYTE PUBLIC;


                /* INPUT QUEUE VARIABLES */
 17  1          DECLARE SW$QUEUE BYTE;

 18  1          ADD$SW0: PROCEDURE(TEMP) PUBLIC;
                /* ADD NEW ENTRY TO INPUT QUEUE.
                   THIS PROCEDURE IS CALLED FROM FOREGROUND.
```

```
                    IF THE QUEUE IS FULL THE ENTRY IS IGNORED. */
 19   2        DECLARE TEMP BYTE;

                /* NOTE: INPUT PROCEDURES MODIFIED TO REDUCE QUEUE LENGTH TO ONE ENTRY
                         THE INPUT QUEUE IS ENABLED ONLY AFTER THE BACKGROUND PROCESSING HAS
                         BEEN COMPLETED AND THE KEYBOARD IS POLLED. THIS PREVENTS SPURIOUS ENTRIES. */

 20   2          IF (SW$QUEUE = 0FFH) AND INPUT$ENABLE THEN SW$QUEUE = TEMP;

 22   2        END;   /* OF ADD$SWQ */


 23   1        REMOVE$SWQ: PROCEDURE BYTE;
                /* REMOVE ENTRY FROM INPUT QUEUE.
                   A VALUE OF 0FFH IS RETURNED IF THE QUEUE IS EMPTY.
                   THIS PROCEDURE IS CALLED FROM THE BACKGROUND THEREFOR INTERRUPTS
                   MUST BE DISABLED WHEN MODIFYING THE QUEUE VARIABLES. */
 24   2        DECLARE SWQ$TEMP BYTE;


 25   2          DISABLE;
 26   2          IF SW$QUEUE <> 0FFH THEN DO;
 28   3            SWQ$TEMP = SW$QUEUE;
 29   3            SW$QUEUE = 0FFH;
 30   3            ENABLE;
 31   3            RETURN(SWQ$TEMP);
 32   3            END;
 33   2          ENABLE;
 34   2          RETURN(0FFH);
 35   2        END;   /* OF REMOVE$SWQ */

 36   1        INITIALIZE$SWQ: PROCEDURE PUBLIC;

 37   2          DISABLE;
 38   2          SW$QUEUE = 0FFH;
 39   2          ENABLE;
 40   2        END;
```

```
                $EJECT
 41  1      CLEAR$INPUT$FIELD: PROCEDURE;
            /* CLEAR THE DISPLAY BUFFER, INSERT THE DELIMETER CHARACTER(S) AND
               COMPUTE THE SIZE OF THE INPUT FIELD (THE NUMBER OF DIGITS PLUS
               THE NUMBER OF DELIMETER CHARACTERS.) */
 42  2      DECLARE (I,N) BYTE;

 43  2        CH$COUNT = 0;
 44  2        DISP$LOC = 0;
 45  2        DISP$MASK = 8000H;
 46  2        CLEAR$STATE = TRUE;
 47  2        FIELD$SIZE = 0;
           /* THE TEST ON NUM$CH WAS ADDED TO ALLOW CLEAR$INPUT$FIELD TO
              BE INVOKED WHEN THE INPUT MODE    EQUAL TO ZERO (SWITCH). */
 48  2        IF ICB.NUM$CH > 0 THEN N = ICB.NUM$CH - 1;
 50  2                          ELSE N = 0;
 51  2        DO I = 0 TO N;
 52  3          IF (DISP$MASK AND IN$DELM$MASK) > 0 THEN DO;
 54  4            DISP$BUF(FIELD$SIZE) = ICB.DELM$CH;
 55  4            FIELD$SIZE = FIELD$SIZE + 1;
 56  4            END;
 57  3          DISP$MASK = SHR(DISP$MASK,1);
 58  3          IN$BUF(I) = '0';
 59  3          DISP$BUF(FIELD$SIZE) = '?';
 60  3          FIELD$SIZE = FIELD$SIZE + 1;
 61  3          END;  /* OF DO I */
 62  2        DISP$MASK = 8000H;

 63  2      END;  /* OF CLEAR$INPUT$FIELD */
```

```
                $EJECT
 64   1         READ: PROCEDURE(ICB$ADD) PUBLIC;
 65   2         DECLARE ICB$ADD ADDRESS;
                /* INPUT MODE CONTROL VARIABLE FORMAT:
                   ICB.MODE AND 0FH = 0 == SWITCH
                                      1 == DIGIT
                                      2 == OCTAL DIGIT
                   IF BIT 7 = 1 THEN READ RETURNS AFTER ICB.NUM$CH DIGITS HAVE BEEN
                      ENTERED (ENTER$KEY NOT REQUIRED).
                   IF BIT 6 = 1 THEN THE INPUT FIELD IS NOT CLEARED UNTIL AFTER THE
                      FIRST CHARACTER HAS BEEN ENTERED.
                */

 66   2            ICB$PTR = ICB$ADD;
 67   2            IN$MODE = ICB.MODE;
 68   2            DATA$ENTERED = FALSE;
 69   2            IN$DELM$MASK = ICB.DELM$MASK;
 70   2            CALL CLEAR$INPUT$FIELD;
 71   2            IF (IN$MODE AND 40H) = 0 THEN
 72   2               CALL UPDATE$LINE(ICB.ECHO$ROW,ICB.ECHO$COL,FIELD$SIZE,.DISP$BUF);
 73   2            CALL UPDATE$SCREEN;
 74   2            INPUT$ENABLE = TRUE;    /* RESET BY INPUT PROCEDURES */
 75   2            DO WHILE INPUT$ENABLE;
 76   3              CALL SUSPEND;     /* WAIT FOR INPUT */
 77   3            END;

 78   2         END;  /* OF READ */
```

```
                $EJECT
 79  1      PROCESS$SWITCH: PROCEDURE PUBLIC;
 80  2      DECLARE ENABLE$LIST$PTR ADDRESS,
               ENABLE$LIST BASED ENABLE$LIST$PTR STRUCTURE(
                SW#MASK(7) BYTE,
                SW$VALUE(1) BYTE),
               MASK BYTE,
               (I,J,N,ROW,COL,CHAR) BYTE;


 81  2      PROCESS$CH: PROCEDURE;

 82  3      ADD$CH: PROCEDURE(CH);
 83  4      DECLARE CH BYTE;
            /* ADD A NEW CHARACTER TO THE INPUT BUFFER AND THE DISPLAY BUFFER
               (AVOIDING DELIMETER CHARACTERS). */

 84  4         CLEAR$STATE = TRUE;
 85  4         IN$BUF(CH$COUNT) = CH;
 86  4         CH$COUNT = CH$COUNT + 1;
 87  4         IF (DISP$MASK AND IN$DELM$MASK) > 0 THEN DO;
 89  5           DISP$LOC = DISP$LOC + 1;
 90  5           END;
 91  4         DISP$BUF(DISP$LOC) = CH;
 92  4         DISP$LOC = DISP$LOC + 1;
 93  4         DISP$MASK = SHR(DISP$MASK,1);
 94  4         CALL UPDATE$LINE(ICB.ECHO$ROW,ICB.ECHO$COL,FIELD$SIZE,.DISP$BUF);

 95  4      END;   /* OF ADD$CH */
```

```
                $EJECT
 96   3         REMOVE$CH: PROCEDURE;
                /* INVOKED IF CH = C(LEAR).
                   IF CLEAR$STATE = TRUE (THE INITIAL STATE) THE LAST CHARACTER ENTERED
                      IS DELETED AND CLEAR$STATE SET FALSE.
                   IF CLEAR$STATE = FALSE THEN THE ENTIRE INPUT FIELD IS DELETED. */

 97   4            IF CH$COUNT > 0 THEN DO;
 99   5              IF CLEAR$STATE THEN DO;
101   6                CLEAR$STATE = FALSE;    /* CLEAR ONE CHARACTER */
102   6                CH$COUNT = CH$COUNT - 1;
103   6                DISP$LOC = DISP$LOC -1;
104   6                DISP$BUF(DISP$LOC) = '?';
105   6                DISP$MASK = SHL(DISP$MASK,1);
106   6                IF (DISP$MASK AND ICB.DELM$MASK) > 0
                          THEN DISP$LOC = DISP$LOC - 1;
108   6                END;    /* OF IF CLEAR$STATE */
109   5              ELSE DO;
110   6                CALL CLEAR$INPUT$FIELD; /* CLEAR THE ENTIRE FIELD */
111   6                CLEAR$STATE = TRUE;
112   6                END;
113   5              CALL UPDATE$LINE(ICB.ECHO$ROW,ICB.ECHO$COL,FIELD$SIZE,.DISP$BUF);
114   5            END;

115   4          END;   /* OF REMOVE */


                /* BEGIN PROCESS$CH CODE */

116   3            IF CHAR = CLEAR$SW THEN DO;
118   4              CALL REMOVE$CH;
119   4              CALL UPDATE$SCREEN;
120   4              RETURN;
121   4              END;
122   3            IF CHAR = ENTER$SW THEN DO;
124   4              INPUT$ENABLE = FALSE;
125   4              RETURN;
126   4              END;
127   3            DATA$ENTERED = TRUE;    /* FIRST CHARACTER RECIEVED */
128   3            IF CH$COUNT < ICB.NUM$CH THEN DO;
130   4              CALL ADD$CH(CHAR);    /* ADD THE NEW CHARACTER */
131   4              CALL UPDATE$SCREEN;
132   4              END;
133   3            IF ((IN$MODE AND 80H) > 0) AND (CH$COUNT = ICB.NUM$CH)
                      THEN INPUT$ENABLE = FALSE;

135   3          END;   /* OF PROCESS$CH */
```

```
                $EJECT
 136  2         DECODE$DIGIT$SW: PROCEDURE BYTE;
                /* THIS PROCEDURE DECODES SWITCHES REPRESENTING A 9-DIGIT KEYBOARD.
                   THE MAPPING IS:
                   SWITCH VALUES   DIGITS
                   15(8) - 17(8)    1 - 3
                   25(8) - 27(8)    4 - 6
                   35(8) - 37(8)    7 - 9
                   46(8)            0
                   45(8)            C
                   47(8)            E
                */
 137  3         DECLARE (R,C) BYTE;

 138  3           C = SWV AND 7;
 139  3           R = SHR(SWV,3) - 1;
 140  3           IF (R < 4) AND (C > 4) THEN DO;
 142  4             C = C - 4 + R*3;
 143  4             IF C = 11 THEN C = 0;
 145  4             RETURN (C + 30H);
 146  4             END;
 147  3           ELSE RETURN (0FFH);

 148  3         END;   /* OF DECODE$DIGIT$SW */

 149  2         DECLARE CH BYTE;
 150  2         DECODE$OCTAL$SW: PROCEDURE BYTE;

 151  3           CH = DECODE$DIGIT$SW;
 152  3           IF CH > '7' THEN RETURN (0FFH);
 154  3                       ELSE RETURN (CH);
 155  3         END;

 156  2         DECODE$INV$ALPHA$SW: PROCEDURE BYTE;

 157  3           IF (SWV > 44Q) OR (SWV < 10Q) THEN RETURN(0FFH);
 159  3           CH = SWV + 39H;
 160  3           IF (CH = 'I') OR (CH = 'O') THEN RETURN(0FFH);
 162  3           RETURN CH;
 163  3         END;   /* OF DECODE$ALPHA$SW */

 164  2         DECODE$EAST$WEST$SW: PROCEDURE BYTE;

 165  3           IF SWV = 25Q THEN RETURN 'E';
 167  3           IF SWV = 27Q THEN RETURN 'W';
 169  3           RETURN 0FFH;
 170  3         END;   /* OF DECODE$EAST$WEST$SW */

 171  2         DECODE$NORTH$SOUTH$SW: PROCEDURE BYTE;

 172  3           IF SWV = 16Q THEN RETURN 'N';
 174  3           IF SWV = 36Q THEN RETURN 'S';
 176  3           RETURN 0FFH;
 177  3         END;   /* OF DECODE$NORTH$SOUTH$SW */
```

```
                $EJECT
                /* BEGIN PROCESS$SWITCH CODE */


178   2           IF NOT INPUT$ENABLE THEN RETURN;
180   2           SWV = REMOVE$SW();   /*GET NEXT CH FROM INPUT QUEUE */
181   2           IF SWV = 0FFH THEN RETURN;  /* INPUT QUEUE EMPTY */
183   2           IF IN$MODE <> SWITCH THEN DO;
185   3             IF (SWV = CLEAR$SW) OR (SWV = ENTER$SW) THEN CHAR = SWV;
                    ELSE
187   3             DO CASE (IN$MODE AND 0FH) - 1;
188   4               CHAR = DECODE$DIGIT$SW;
189   4               CHAR = DECODE$OCTAL$SW;
190   4               CHAR = DECODE$NORTH$SOUTH$SW;
191   4               CHAR = DECODE$EAST$WEST$SW;
192   4               CHAR = DECODE$DNV$ALPHA$SW;
193   4               END;
194   3             IF CHAR <> 0FFH THEN DO;
196   4               CALL   PROCESS$CH;
197   4               RETURN;
198   4               END;
199   3             END;  /* OF IF IN$MODE ...DO; */

                  /* INPUT MODE IS NOT "DIGIT" OR
                     IS "DIGIT" AND DIGIT SWITCH WAS NOT PRESSED.
                     TEST FOR SPECIAL FUNCTION KEY. */
200   2           I = SWV - PRIMARY$SW;

201   2           IF I = 0 THEN CALL RESTART;

                  /* THE FOLLOWING CODE IS BYPASSED TO REDUCE MEMORY REQUIREMENTS
                     IF I < 6 THEN DO;
                       DO CASE I;
                         CALL RESTART;
                         CALL IFF$EMER;
                         CALL ZERO$CODE;
                         GO TO A;
                         GO TO A;
                         GO TO A;
                         CALL RPLY;/
                         END;
                       RETURN;
                  A:
                       END;
                  */

                  /* INPUT IS NOT A SPECIAL FUNCTION SWITCH SO IT MUST BE AN
                     ENABLED SWITCH. DETERMINE RELATIVE INDEX. */
203   2           ENABLE$LIST$PTR = ICB.SW$ENABLE$PTR;
204   2           ROW = SHR(SWV,3);
205   2           COL = SWV AND 7;
206   2           IF COL > 0 THEN MASK = SHR(80H,COL);
208   2                      ELSE MASK = 80H;
209   2           SW$INDEX = 0;
210   2           IF (MASK AND ENABLE$LIST.SW$MASK(ROW)) > 0 THEN DO;
                  /* DETERMINE THE INDEX VALUE OF THIS SWITCH BY COUNTING THE NUMBER OF
                     1'S IN THE MASK WORDS PRECEEDING THE MASK FOR THIS ROW. */
```

```
212  3          IF ROW > 0 THEN DO;
214  4            N = ROW - 1;
215  4            DO I = 0 TO N;
216  5              MASK = ENABLE$LIST.SW$MASK(I);
217  5              DO WHILE MASK > 0;
218  6                IF (MASK AND 80H) > 0 THEN SW$INDEX = SW$INDEX + 1;
220  6                MASK = SHL(MASK,1);
221  6                END;
222  5              END;  /* OF DO I */
223  4            END;    /* OF IF ROW > 0 */

             /* COUNT THE NUMBER OF 1'S IN THE MASK WORD FOR THIS ROW */
224  3          MASK = ENABLE$LIST.SW$MASK(ROW);
225  3          IF COL > 0 THEN DO;
227  4            N = COL - 1;
228  4            DO I = 0 TO N;
229  5              IF (MASK AND 80H) > 0 THEN SW$INDEX = SW$INDEX + 1;
231  5              MASK = SHL(MASK,1);
232  5              END;  /* OF DO I */
233  4            END;    /* OF IF COL > 0 */

234  3          I = SW$INDEX/2; /*SW VALUE NIBBLES ARE PACKED 2 PER BYTE.*/
235  3          IF SW$INDEX THEN SW$INDEX = ENABLE$LIST.SW$VALUE(I) AND 0FH;
237  3                      ELSE SW$INDEX = SHR(ENABLE$LIST.SW$VALUE(I),4);
238  3          INPUT$ENABLE = FALSE;
239  3          END;  /* OF IF(MASK AND ENABLE$LIST... */

240  2        END;   /* OF PROCESS$SWITCH */


241  1        END;   /* OF IN: DO /*
```

MODULE INFORMATION:

```
    CODE AREA SIZE     = 053BH   1339D
    VARIABLE AREA SIZE = 0043H     67D
    MAXIMUM STACK SIZE = 000AH     10D
    419 LINES READ
    0 PROGRAM ERROR(S)
```

END OF PL/M-80 COMPILATION

```
ISIS-II PL/M-80 V3.0 COMPILATION OF MODULE DISP
OBJECT MODULE PLACED IN :F1:ABSDIS.OBJ
COMPILER INVOKED BY:  PLM80 :F1:ABSDIS.SRC DATE(21JUNE79) DEBUG


            $TITLE('DISP')
  1         DISP: DO;
            /* CDU DISPLAY PROCEDURES */

  2  1      DECLARE TRUE LITERALLY '0FFH',
                FALSE LITERALLY '0';
  3  1      DECLARE RM$BUFA(1) BYTE EXTERNAL,
              RM$BUFB(1) BYTE EXTERNAL;
  4  1      DECLARE BLANK$LINE(24) BYTE EXTERNAL;
  5  1      UPDATE$RM: PROCEDURE EXTERNAL;
  6  2      END;
  7  1      FILL$BUF: PROCEDURE(ROW,COL,BUF$ADD,REF$BUF$ADD,NCHAR,MODE) EXTERNAL;
  8  2      DECLARE (ROW,COL,NCHAR,MODE) BYTE, (BUF$ADD,REF$BUF$ADD) ADDRESS;
  9  2      END;

            /* THE FOLLOWING ARRAY CONTAINS THE ASCII CHARACTERS APPEARING ON THE
               NINE ROWS OF THE DISPLAY. */
 10  1      DECLARE CURRENT$DISP(9) STRUCTURE(CHAR(24) BYTE) PUBLIC;


 11  1      UPDATE$SCREEN: PROCEDURE PUBLIC;
 12  2        CALL UPDATE$RM; /*INITIATE DMA TRANSFER TO REFRESH MEMORY */
 13  2      END;



 14  1      UPDATE$LINE: PROCEDURE(ROW,COL,NCHAR,TEXT$PTR) PUBLIC;
            /* THE INPUT MUST BE ASCII TEXT */

 15  2      DECLARE ROW BYTE,  /* ROW NUMBER */
                COL BYTE,   /* STARTING COLUMN NUMBER */
                NCHAR BYTE, /* NUMBER OF CHS TO BE UPDATED */
                TEXT$PTR ADDRESS; /* TEXT STRING STARTING ADDRESS */
 16  2      DECLARE CUR$PTR ADDRESS;
 17  2      DECLARE (TEXT BASED TEXT$PTR)(1) BYTE,
                 (CHAR BASED CUR$PTR)(1) BYTE,
                 I BYTE;

 18  2        CUR$PTR = .CURRENT$DISP(ROW).CHAR(COL);
 19  2        CALL FILL$BUF(ROW,COL,TEXT$PTR,CUR$PTR,NCHAR,TRUE);
 20  2        NCHAR = NCHAR - 1;
 21  2        DO I = 0 TO NCHAR;
 22  3          IF TEXT(I) <> ' ' THEN CHAR(I) = TEXT(I);
 24  3          END;

 25  2      END;  /* OF UPDATE$LINE */



 26  1      CLEAR: PROCEDURE(ROW) PUBLIC;
```

```
                /* CLEARS BOTH THE CURRENT DISPLAY BUFFER AND THE REFRESH MEMORY
                   BUFFERS FROM THE SPECIFIED ROW TO THE LAST ROW (ROW 9).
                   NOTE: DNV WAYPOINT DATA OVERLAYS RM$BUFB. */

 27   2        DECLARE ROW BYTE;
 28   2        DECLARE (K,N) ADDRESS;

 29   2           IF ROW = 0 THEN K = 0;
 31   2                      ELSE K = 64 + DOUBLE(ROW)*160;
 32   2           N = 1535 - K;
 33   2           RM$BUFA(K) = 0;
 34   2           CALL MOVE(N,.RM$BUFA(K),.RM$BUFA(K+1));
 35   2           DO N = K TO 1535;
 36   3             RM$BUFB(N) = RM$BUFB(N) AND 0F0H;
 37   3             END;
 38   2           CURRENT$DISP(ROW).CHAR(0) = ' ';
 39   2           CALL MOVE(215 - ROW*24,.CURRENT$DISP(ROW),
                                .CURRENT$DISP(ROW).CHAR(1));
 40   2        END;


 41   1        CLEAR$LINE: PROCEDURE(LINE$NUM) PUBLIC;
 42   2        DECLARE LINE$NUM BYTE;

 43   2           CALL FILL$BUF(LINE$NUM,0,.BLANK$LINE,.CURRENT$DISP(LINE$NUM),24,FALSE);
 44   2           CALL MOVE(24,.BLANK$LINE,.CURRENT$DISP(LINE$NUM));
 45   2        END;
```

```
                $EJECT
 46   1        DISPLAY: PROCEDURE(IN$PTR) PUBLIC;
 47   2        DECLARE IN$PTR ADDRESS;
                /* UNPACK INPUT TEXT STRING AND FILL CURRENT DISPLAY BUFFER AND
                   THE REFRESH MEMORY BUFFER.
                   THE INPUT TEXT STRING IS ENCODED IN THE FOLLOWING FORMAT:
                   1. BIT 7 = 0, BITS 0 - 6 IS AN ASCII CHARACTER.
                   2. BIT 7 = 1, BITS 5,6: KEY, BITS 0 - 4: N
                      KEY = 0 ==> ROW := N
                      KEY = 1 ==> COL := N
                      KEY = 2 ==> REPEAT THE NEXT CHARACTER N TIMES.
                      KEY = 3 ==> NOT ASSIGNED.
                   NOTE: THE FIRST CHARACTER IN ANY SEQUENCE MUST BE A ROW SPECIFIER.
                         THE LAST CHARACTER IN ANY SEQUENCE MUST BE A ZERO TERMINATOR. */

 48   2        DECLARE LINE(24) BYTE,
                   (ROW,COL,IX,N,KEY,CH) BYTE,
                   (IN BASED IN$PTR)(1) BYTE;



 49   2        NEW$ROW: PROCEDURE;
 50   3        DECLARE DEST$PTR ADDRESS,
                   (DEST BASED DEST$PTR)(1) BYTE,
                   I BYTE;

 51   3           DEST$PTR = .CURRENT$DISP(ROW);
 52   3           CALL FILL$BUF(ROW,0,.LINE,DEST$PTR,24,TRUE);
 53   3           DO I = 0 TO 23;
 54   4             IF LINE(I) <> ' ' THEN DO;
 56   5               DEST(I) = LINE(I);  /* STORE CH IN CURRENT DISP BUFFER */
 57   5               LINE(I) = ' ';  /* BLANK LINE FOR NEXT TIME AROUND */
 58   5               END;
 59   4             END;
 60   3           ROW = N;
 61   3           COL = 0;
 62   3        END;

 63   2        REPEAT: PROCEDURE;
 64   3        DECLARE I BYTE;

 65   3           IF (N = 0) OR (N > 24) THEN RETURN;
 67   3           IF N + COL > 23 THEN N = 23 - COL;
 69   3           IX = IX + 1;
 70   3           CH = IN(IX);    /* GET THE CHARACTER TO BE REPEATED */
 71   3           N = N - 1;
 72   3           DO I = 0 TO N;
 73   4             LINE(COL) = CH;
 74   4             COL = COL + 1;
 75   4           END;
 76   3        END;
```

```
                $EJECT
                /* BEGIN DISPLAY CODE */
 77   2            LINE(0) = ' ';  /* CLEAR THE LINE BUFFER */
 78   2            CALL MOVE(23,.LINE,.LINE(1));
 79   2            ROW = IN(0) AND 1FH;
 80   2            CH = IN(1);
 81   2            IX = 1;
 82   2            COL = 0;
 83   2            DO WHILE CH > 0;
 84   3              IF (CH AND 80H) = 0 THEN DO;
 86   4                LINE(COL) = CH; /* INSERT NEXT ASCII CHARACTER */
 87   4                COL = COL + 1;
 88   4                END;
 89   3              ELSE DO;
 90   4                N = CH AND 1FH; /* PROCESS CONTROL CHARACTER */
 91   4                KEY = SHR(CH,5) AND 3;
 92   4                DO CASE KEY;
 93   5                  CALL NEW$ROW; /*ROW SPECIFIER ENCOUNTERED */
 94   5                  COL = N;      /*COLUMN SPECIFIER ENCOUNTERED */
 95   5                  CALL REPEAT;  /*REPEAT SPECIFIER ENCOUNTERED */
 96   5                  ;         /* NOT ASSIGNED */
 97   5                  END;  /* OF DO CASE */
 98   4                END;    /* OF ELSE DO */
 99   3              IX = IX + 1;
100   3              CH = IN(IX);
101   3            END;    /* OF DO WHILE */
102   2            CALL NEW$ROW;   /* PROCESS LAST ROW */

103   2          END;  /* OF DISPLAY */
```

```
                $EJECT
104   1         INSERT: PROCEDURE(NCHAR,SOURCE$PTR,DEST$PTR,DELM$CH,DELM$MASK)
                    PUBLIC;
                /* COPY CHARACTERS FROM A SOURCE BUFFER TO A DESTINATION BUFFER AND
                   INSERT A DELEMETER CHARACTER UNDER CONTROL OF A MASK. THE PRIMARY
                   USE OF THIS PROCEDURE IS IN FORMATTING DIGIT STRINGS FOR PRESENTATION
                   ON THE DISPLAY. NOTE: THE MASK CAN SPAN ONLY 16 BITS BUT THE NUMBER
                   OF CHARACTERS THAT MAY BE MOVED IS LIMITED ONLY BY THE SIZE OF
                   THE BYTE VARIABLES INVOLVED. */
105   2         DECLARE NCHAR BYTE,    /*NUMBER OF CHARACTERS IN THE SOURCE BUFFER*/
                   SOURCE$PTR ADDRESS,
                   DEST$PTR ADDRESS,
                   DELM$CH BYTE,
                   DELM$MASK ADDRESS;
106   2         DECLARE (SOURCE BASED SOURCE$PTR)(1) BYTE,
                    (DEST BASED DEST$PTR)(1) BYTE,
                    (I,LOC) BYTE;

107   2           LOC = 0;
108   2           I = 0;
109   2           DO WHILE I < NCHAR;
110   3             IF (DELM$MASK AND 8000H) > 0 THEN DEST(LOC) = DELM$CH;
112   3             ELSE DO;
113   4               DEST(LOC) = SOURCE(I);
114   4               I = I + 1;
115   4               END;
116   3             DELM$MASK = SHL(DELM$MASK,1);
117   3             LOC = LOC + 1;
118   3             END;
119   2         END;   /* OF INSERT */

120   1         END;   /* OF DISP: DO */


MODULE INFORMATION:

    CODE AREA SIZE     = 03DAH    986D
    VARIABLE AREA SIZE = 0114H    276D
    MAXIMUM STACK SIZE = 000CH     12D
    191 LINES READ
    0 PROGRAM ERROR(S)

END OF PL/M-80 COMPILATION
```

```
ISIS-II PL/M-80 V3.1 COMPILATION OF MODULE COM
OBJECT MODULE PLACED IN :F1:COM.OBJ
COMPILER INVOKED BY:  PLM80 :F1:COM.SRC DATE(30OCT79) DEBUG


                $TITLE('COM')
 1              COM: DO;
                $NOLIST INCLUDE(:F1:CDULIT.SRC)
 4   1          ERROR: PROCEDURE(CODE) EXTERNAL;
 5   2          DECLARE CODE BYTE;
 6   2          END;
 7   1          CLEAR: PROCEDURE(START$ROW) EXTERNAL;
 8   2          DECLARE START$ROW BYTE;
 9   2          END;
10   1          GRID: PROCEDURE(POINTER) EXTERNAL;
11   2          DECLARE POINTER ADDRESS;
12   2          END;
13   1          DISPLAY: PROCEDURE(IN$PTR) EXTERNAL;
14   2          DECLARE IN$PTR ADDRESS;
15   2          END;
16   1          READ: PROCEDURE(ICB$PTR) EXTERNAL;
17   2          DECLARE ICB$PTR ADDRESS;
18   2          END;
19   1          UPDATE$LINE: PROCEDURE(ROW,COL,NCHAR,TEXT$PTR) EXTERNAL;
20   2          DECLARE (ROW,COL,NCHAR) BYTE, TEXT$PTR ADDRESS;
21   2          END;
22   1          CLEAR$TEMP$BUF: PROCEDURE EXTERNAL;
23   2          END;
24   1          INSERT: PROCEDURE(NCHAR,SOURCE$PTR,DEST$PTR,DELM$CH,DELM$MASK) EXTERNAL;
25   2          DECLARE (NCHAR,DELM$CH) BYTE, (SOURCE$PTR,DEST$PTR,DELM$MASK) ADDRESS;
26   2          END;
27   1          UPDATE$SCREEN: PROCEDURE EXTERNAL;
28   2          END;
29   1          DISPLAY$DIGIT$KB: PROCEDURE EXTERNAL;
30   2          END;
31   1          LIMIT$TEST: PROCEDURE(BUF$PTR,NUM$DIGITS,MIN$PTR,MAX$PTR) BYTE EXTERNAL;
32   2          DECLARE (BUF$PTR,MIN$PTR,MAX$PTR) ADDRESS,
                   NUM$DIGITS BYTE;
33   2          END;

                /* LOCAL VARIABLES WHOOSE VALUES ARE OBTAINED FROM THE CURRENT
                   CONTROL BLOCK (CNTL) OR COMPUTED FROM VALUES THEREIN. */
34   1          DECLARE ACTIVE$CHAN BYTE,
                   LAST$ACTIVE$CHAN BYTE,
                   FREQ$BASE$ADD ADDRESS,
                   FREQ$SIZE BYTE,
                   FREQ$SIZE$PLUS$ONE BYTE,
                   INSERT$MASK ADDRESS,
                   FREQ$MIN$ADD ADDRESS,
                   FREQ$MAX$ADD ADDRESS,
                   MAN$FREQ$ICB$ADD ADDRESS;

                /* EXTERNAL VARIABLES */
35   1          DECLARE
                   BLANK$LINE(24) BYTE EXTERNAL,
                   IN$BUF(16) BYTE EXTERNAL,
```

```
                    DATA$ENTERED BYTE EXTERNAL,
                    SW BYTE EXTERNAL,
                    TEMP$BUF(24) BYTE EXTERNAL,
                    OFF$ON$TEXT(6) BYTE EXTERNAL,
                    SW$INDEX BYTE EXTERNAL;

 36  1      DECLARE CNTL$ADD ADDRESS;
 37  1      DECLARE CNTL BASED CNTL$ADD STRUCTURE(
                    LABEL$PTR ADDRESS,
                    ACTIVE$CHAN$PTR ADDRESS,
                    LAST$ACTIVE$CHAN$PTR ADDRESS,
                    FREQ$PTR ADDRESS,
                    SIZE BYTE,
                    MASK ADDRESS,
                    MIN$PTR ADDRESS,
                    MAX$PTR ADDRESS,
                    MAN$FREQ$ICB$PTR ADDRESS);
 38  1      DECLARE SUBMODE$LAST$ENABLE STRUCTURE(
                    SW$MASK(7) BYTE,
                    SW$VALUE(1) BYTE) PUBLIC DATA(0,0,0,0,0,0,90H,0);
 39  1      DECLARE SUBMODE$LAST$STEP$ENABLE STRUCTURE(
                    SW$MASK(7) BYTE,
                    SW$VALUE(1) BYTE) PUBLIC DATA(0,0,0,0,0,0,98H,01H);
 40  1      DECLARE DIGIT$SEL$ICB STRUCTURE(
                    MODE BYTE,
                    NUM$CH BYTE,
                    DELM$CH BYTE,
                    DELM$MASK ADDRESS,
                    ECHO$ROW BYTE,
                    ECHO$COL BYTE,
                    SW$ENABLE ADDRESS)
                    DATA(NOCLEAR$CNTL$DIGIT,1,0,0,2,3,.SUBMODE$LAST$STEP$ENABLE);
 41  1      DECLARE PAGE0$SW$ENABLE STRUCTURE(
                    SW$MASK(7) BYTE,
                    SW$VALUE(11) BYTE) DATA(
                    0,0EEH,0EEH,0EEH,0,0,98H,
                    00H,01H,11H,22H,23H,33H,44H,45H,55H,67H,80H);
 42  1      DECLARE PAGE1$SW$ENABLE STRUCTURE(
                    SW$MASK(7) BYTE,
                    SW$VALUE(8) BYTE) DATA(
                    0,0EEH,0E0H,0E0H,0,0,98H,
                    00H,01H,11H,22H,23H,33H,45H,60H);
                  /* THIS IS INCLUDED TO INSURE INITIALIZATION OF RAM STORAGE OF
                    STAT$PAGE$ICB. */
 43  1      DECLARE INITIAL$STAT$PAGE$ICB STRUCTURE(
                    MODE BYTE,
                    NUM$CH BYTE,
                    DELM$CH BYTE,
                    DELM$MASK ADDRESS,
                    ECHO$ROW BYTE,
                    ECHO$COL BYTE,
                    SW$ENABLE ADDRESS) DATA(SWITCH,0,0,0,0,0,.PAGE0$SW$ENABLE);
 44  1      DECLARE STAT$PAGE$ICB STRUCTURE(
                    MODE BYTE,
                    NUM$CH BYTE,
                    DELM$CH BYTE,
                    DELM$MASK ADDRESS,
```

PL/M-80 COMPILER COM

```
ECHOSROW BYTE,
ECHOSCOL BYTE,
SWSENABLE ADDRESS);
```

```
                $EJECT
 45  1      INITIALIZE$COM: PROCEDURE(CNTL$PTR) PUBLIC;
            /* THIS PROCEDURE MUST BE INVOKED PRIOR TO ANY OF THE FOLLOWING
               PROCEDURES. */
 46  2      DECLARE CNTL$PTR ADDRESS;

 47  2         CALL MOVE(9,.INITIAL$STAT$PAGE$ICB,.STAT$PAGE$ICB);
 48  2         CNTL$ADD = CNTL$PTR;
 49  2         CALL MOVE(1,CNTL.ACTIVE$CHAN$PTR,.ACTIVE$CHAN);
 50  2         CALL MOVE(1,CNTL.LAST$ACTIVE$CHAN$PTR,.LAST$ACTIVE$CHAN);
 51  2         FREQ$BASE$ADD = CNTL.FREQ$PTR;
 52  2         FREQ$SIZE = CNTL.SIZE;
 53  2         FREQ$SIZE$PLUS$ONE = FREQ$SIZE + 1;
 54  2         INSERT$MASK = CNTL.MASK;
 55  2         FREQ$MIN$ADD = CNTL.MIN$PTR;
 56  2         FREQ$MAX$ADD = CNTL.MAX$PTR;
 57  2         MAN$FREQ$ICB$ADD = CNTL.MAN$FREQ$ICB$PTR;

 58  2      END;


 59  1      FREQ$ADD: PROCEDURE(CHAN) ADDRESS;
 60  2      DECLARE CHAN BYTE;
            /* COMPUTE OFFSET INTO FREQ ARRAY. */

 61  2         RETURN(FREQ$BASE$ADD + CHAN * FREQ$SIZE);
 62  2      END;


 63  1      DISPLAY$CHAN$FREQ: PROCEDURE(CHAN$IX) PUBLIC;
 64  2      DECLARE CHAN$IX BYTE;

 65  2         CALL CLEAR$TEMP$BUF;
 66  2         CALL MOVE(7,.('CH-  F-'),.TEMP$BUF);
 67  2         CALL INSERT(FREQ$SIZE,FREQ$ADD(CHAN$IX),.TEMP$BUF(7),'.',INSERT$MASK);
 68  2         TEMP$BUF(3) = CHAN$IX + 30H;
 69  2         CALL UPDATE$LINE(2,0,15,.TEMP$BUF);

 70  2      END;  /* OF DISPLAY$ACTIVE$CHAN */

 71  1      UPDATE$FREQ: PROCEDURE(CHAN$IX) BYTE;
 72  2      DECLARE CHAN$IX BYTE;

 73  2         IF LIMIT$TEST(.IN$BUF,FREQ$SIZE,FREQ$MIN$ADD,FREQ$MAX$ADD)
              THEN DO;
 75  3            CALL MOVE(FREQ$SIZE,.IN$BUF,FREQ$ADD(CHAN$IX));
 76  3            RETURN TRUE;
 77  3            END;
 78  2           ELSE DO;
 79  3            CALL ERROR(0);
 80  3            RETURN FALSE;
 81  3            END;

 82  2      END;  /* OF UPDATE$FREQ */


 83  1      LAST$FREQ: PROCEDURE;
```

```
 84  2        ACTIVE$CHAN = LAST$ACTIVE$CHAN;
 85  2        CALL MOVE(1,.LAST$ACTIVE$CHAN,CNTL.ACTIVE$CHAN$PTR);
 86  2        CALL DISPLAY$CHAN$FREQ(ACTIVE$CHAN);

 87  2      END;  /* OF LAST$FREQ */
```

```
                $E.JECT
 88   1         CHAN$SEL: PROCEDURE PUBLIC;
 89   2         DECLARE I BYTE;
 90   2         DECLARE CHAN$SEL$TABLEAU(*) BYTE DATA(
                    ROW2,'CH-?',
                    ROW3,COL1,'CHAN',
                    ROW4,COL1,'SEL',0);

 91   2           CALL CLEAR(2);
 92   2           CALL DISPLAY$DIGIT$ICB;
 93   2           CALL DISPLAY(.CHAN$SEL$TABLEAU);
 94   2           I = OFFH;
 95   2           DO FOREVER;
 96   3             CALL READ(.DIGIT$SEL$ICB);
 97   3             IF DATA$ENTERED THEN DO;
 99   4               I = IN$BUF(0) - 30H;
100   4               CALL DISPLAY$CHAN$FREQ(I);
101   4               END;
102   3             ELSE IF (SW = ENTER$SW) AND (I < OFFH) THEN DO;
104   4               LAST$ACTIVE$CHAN = ACTIVE$CHAN;
105   4               CALL MOVE(1,.LAST$ACTIVE$CHAN,CNTL.LAST$ACTIVE$CHAN$PTR);
106   4               ACTIVE$CHAN = I;
107   4               CALL MOVE(1,.ACTIVE$CHAN,CNTL.ACTIVE$CHAN$PTR);
108   4               RETURN;
109   4               END;
                    IF SW = SUBMODE$SW THEN RETURN;
112   3             IF SW = CLEAR$SW THEN DO;
114   4               CALL UPDATE$LINE(2,7,FREQ$SIZE$PLUS$ONE,.BLANK$LINE);
115   4               I = OFFH;
116   4               END;
117   3             END;  /* OF DO FOREVER */
118   2         END;  /* OF CHAN$SEL */
```

```
                $EJECT
 119   1        MAN$FREQ: PROCEDURE(CHAN) PUBLIC;
 120   2        DECLARE CHAN BYTE;
 121   2        DECLARE MAN$FREQ$TABLEAU(*) BYTE DATA(
                   ROW3,COL6,'MAN',
                   ROW4,COL6,'FREQ',0);

 122   2           CALL CLEAR(2);
 123   2           CALL DISPLAY$DIGIT$KB;
 124   2           CALL DISPLAY(.MAN$FREQ$TABLEAU);
 125   2           CALL DISPLAY$CHAN$FREQ(CHAN);
 126   2           DO FOREVER;
 127   3             CALL READ(MAN$FREQ$ICB$ADD);
 128   3             IF DATA$ENTERED AND (SWV = ENTER$SW) THEN DO;
 130   4               IF UPDATE$FREQ(CHAN) THEN RETURN;
 132   4               END;
 133   3             ELSE IF SWV = LAST$SW THEN CALL LAST$FREQ;
                       IF SWV = SUBMODE$SW THEN RETURN;
 137   3             END;

 138   2        END;   /* OF MAN$FREQ */



 139   1        PRST$CHAN: PROCEDURE PUBLIC;
 140   2        DECLARE PRST$CHAN$TABLEAU(*) BYTE DATA(
                   ROW2,'CH-?',COL5,'F-',
                   ROW3,COL11,'PRST',
                   ROW4,COL11,'CHAN',0);
 141   2        DECLARE I BYTE;

 142   2           CALL CLEAR(2);
 143   2           CALL DISPLAY$DIGIT$KB;
 144   2           CALL DISPLAY(.PRST$CHAN$TABLEAU);
 145   2           CALL READ(.DIGIT$SEL$ICB);
 146   2           IF DATA$ENTERED THEN DO;
 148   3             I = IN$BUF(0) - 30H;
 149   3             DO WHILE I < 10;
 150   4               CALL DISPLAY$CHAN$FREQ(I);
 151   4               CALL READ(MAN$FREQ$ICB$ADD);
 152   4               IF DATA$ENTERED AND (SWV = ENTER$SW) THEN DO;
 154   5                 IF UPDATE$FREQ(I) THEN I = I + 1;
 156   5                 END;
 157   4               ELSE DO;
 158   5                 IF SWV = SUBMODE$SW THEN RETURN;
 160   5                 IF SWV = LAST$SW THEN CALL LAST$FREQ;
 162   5                 IF SWV = STEP$SW THEN I = I + 1;
 164   5                 END;
 165   4               END;    /* OF DO WHILE */
 166   3             END;  /* OF DATA$ENTERED */
 167   2        END;   /* OF PRST$CHAN */
```

```
                $EJECT
168   1         STAT$PAGE: PROCEDURE PUBLIC;

169   2         GENERATE$STAT$HEADER: PROCEDURE(PAGE);
170   3         DECLARE PAGE BYTE;

171   3           CALL CLEAR(0);
172   3           CALL CLEAR$TEMP$BUF;
173   3           CALL MOVE(3,.CNTL.LABEL$PTR,.TEMP$BUF);
174   3           CALL MOVE(16,.('CHAN STAT     /2'),.TEMP$BUF(4));
175   3           TEMP$BUF(17) = PAGE + 31H;
176   3           CALL UPDATE$LINE(0,4,20,.TEMP$BUF);
177   3         END;   /* OF GENERATE$STAT$HEADER */


178   2         PROCESS$PAGE: PROCEDURE(PAGE$NUM,SW$ENABLE$PTR);
179   3         DECLARE PAGE$NUM BYTE,
                    I BYTE,
                    SW$ENABLE$PTR ADDRESS;
180   3         DECLARE PAGE$MAP(2) STRUCTURE(LIST(6) BYTE) DATA(
                    0,3,1,4,2,5,        /* PAGE 1 */
                    6,9,7,0FFH,8,0FFH); /* PAGE 2 */
181   3         DECLARE SW$IX$MAP(2) STRUCTURE(LIST(6) BYTE) DATA(
                    0,3,1,4,2,5,        /* PAGE 1 */
                    6,9,7,8,0,0);       /* PAGE 2 */
182   3         DECLARE MAX$SW$IX(2) BYTE DATA(6,4);


183   3         DISPLAY$STAT$LINE: PROCEDURE(LINE$NUM);
184   4         DECLARE LINE$NUM BYTE;
185   4         DECLARE CHAN BYTE;

186   4           CALL CLEAR$TEMP$BUF;
                /* FORMAT LEFT HALF OF LINE */
187   4           CHAN = PAGE$MAP(PAGE$NUM).LIST(LINE$NUM*2);
188   4           TEMP$BUF(0) = CHAN + 30H;
189   4           IF CHAN = ACTIVE$CHAN THEN TEMP$BUF(1) = '*';
191   4           CALL INSERT(FREQ$SIZE,FREQ$ADD(CHAN),.TEMP$BUF(2),'.',INSERT$MASK);
                /* FORMAT RIGHT HALF OF LINE */
192   4           CHAN = PAGE$MAP(PAGE$NUM).LIST(LINE$NUM*2 + 1);
193   4           IF CHAN < OFFH THEN DO;
195   5             TEMP$BUF(11) = CHAN + 30H;
196   5             IF CHAN = ACTIVE$CHAN THEN TEMP$BUF(12) = '*';
198   5             CALL INSERT(FREQ$SIZE,FREQ$ADD(CHAN),.TEMP$BUF(13),'.',INSERT$MASK);
199   5             END;
200   4           CALL UPDATE$LINE(LINE$NUM*2+2,1,21,.TEMP$BUF);
201   4         END;   /* OF DISPLAY$STAT$LINE */


                /* BEGIN PROLESS$PAGE CODE.
                   PAGE$NUM AND SW$ENABLE$PTR ARE PASSED AS ARGUMENTS. */

202   3           STAT$PAGE$ICB.SW$ENABLE = SW$ENABLE$PTR;
203   3           DO FOREVER;
204   4             CALL GENERATE$STAT$HEADER(PAGE$NUM);
205   4             DO I = 0 TO 2;
206   5               CALL DISPLAY$STAT$LINE(I);
```

```
207  5            END;
208  4          CALL READ(.STAT$PAGE$ICB);
209  4          IF SW$INDEX < MAX$SW$IX(PAGE$NUM) THEN DO;
211  5            CALL MAK$FREE(SW$IX$MAP(PAGE$NUM),LIST(SW$INDEX));
212  5            END;
213  4          ELSE IF SWV = SUBMODE$SW THEN RETURN;
               IF SWV = STEP$SW THEN RETURN;
217  4          IF SWV = LAST$SW THEN CALL LAST$FREE;
219  4          END;  /* OF DO FOREVER */
220  3        END;   /* OF PROCESS PAGE */

           /* BEGIN STAT$PAGE CODE */
221  2        DO FOREVER;
222  3          CALL PROCESS$PAGE(0,.PAGE0$SW$ENABLE);
223  3          IF SWV = SUBMODE$SW THEN RETURN;
225  3          CALL PROCESS$PAGE(1,.PAGE1$SW$ENABLE);
226  3          IF SWV = SUBMODE$SW THEN RETURN;
228  3          END;
229  2        END;   /* OF STAT$PAGE */



230  1        SWAP: PROCEDURE(A$PTR, B$PTR) PUBLIC;
231  2        DECLARE (A$PTR, B$PTR) ADDRESS;
232  2        DECLARE A BASED A$PTR BYTE,
                   B BASED B$PTR BYTE,
                   T BYTE;


233  2          T = A;
234  2          A = B;
235  2          B = T;
236  2        END;   /* OF SWAP */

237  1        END;   /* OF COM */
```

MODULE INFORMATION:

```
    CODE AREA SIZE     = 0577H   1399D
    VARIABLE AREA SIZE = 002DH     45D
    MAXIMUM STACK SIZE = 0010H     16D
    409 LINES READ
    0 PROGRAM ERROR(S)
```

END OF PL/M-80 COMPILATION

```
ISIS-II PL/M-80 V3.1 COMPILATION OF MODULE VHF
OBJECT MODULE PLACED IN :F1:VHF.OBJ
COMPILER INVOKED BY: PLM80 :F1:VHF.SRC DATE(30OCT79) DEBUG


              $TITLE('VHF')
               /* VHF HAS BEEN CHANGED TO READ FM */
  1            VHF: DO;
              $NOLIST INCLUDE(:F1:[illegible])
  4    1        INITIALIZE$COM: PROCEDURE(CNTL$PTR) EXTERNAL;
  5    2        DECLARE CNTL$PTR ADDRESS;
  6    2        END;
  7    1        CHAN$SEL: PROCEDURE EXTERNAL;
  8    2        END;
  9    1        MAN$FREQ: PROCEDURE(CHAN) EXTERNAL;
  [illegible]   2        DECLARE CHAN BYTE;
                END;
                [illegible]CHAN: PROCEDURE EXTERNAL;
                END;
                [illegible]: PROCEDURE EXTERNAL;
                [illegible]
                [illegible]FREQ: PROCEDURE(CHAN) EXTERNAL;
                [illegible]
                [illegible] EXTERNAL;
 [illegible]
 [illegible]
 [illegible]
 23   2        [illegible]
 24   2        [illegible]
 25   1        [illegible]
 26   2        DECLARE [illegible]
 27   2        END;
 28   1        READ: PROCEDURE [illegible]
 29   2        DECLARE ICB$PTR [illegible]
 30   2        END;
 31   1        UPDATE$LINE: PROCEDURE(ROW,[illegible]
 32   2        DECLARE (ROW,COL,NCHAR) BYTE, [illegible]
 33   2        END;
 34   1        SWAP: PROCEDURE(A, B) EXTERNAL;
 35   2        DECLARE (A, B) ADDRESS;
 36   2        END;

               /* EXTERNAL VARIABLES */
 37   1        DECLARE
                  OFF$ON$TEXT(6) BYTE EXTERNAL,
                  SWV BYTE EXTERNAL,
                  SW$INDEX BYTE EXTERNAL,
                  SUBMODE$LAST$STEP$ENABLE ADDRESS EXTERNAL,
                  VHF$ACTIVE$CHAN BYTE EXTERNAL,
                  LAST$VHF$ACTIVE$CHAN BYTE EXTERNAL,
                  VHF$STATUS BYTE EXTERNAL,
                  VHF$FREQ(10) STRUCTURE(DIGITS(4) BYTE) EXTERNAL,
                  SUBMODE$GRID ADDRESS EXTERNAL;
```

```
38  1     DECLARE I BYTE;
39  1     DECLARE MIN$FREQ(4) BYTE DATA('3000'),
              MAX$FREQ(4) BYTE DATA('7595');

40  1     INIT$VHF: PROCEDURE PUBLIC;

41  2       DO I = 0 TO 9;
42  3         CALL MOVE(4,.MIN$FREQ,.VHF$FREQ(I));
43  3         END;
44  2       VHF$ACTIVE$CHAN = 0;
45  2       LAST$VHF$ACTIVE$CHAN = 0;
46  2       VHF$STATUS = 0;
47  2     END;


48  1     VHF$SUBMODE: PROCEDURE PUBLIC;

49  2     DECLARE MAN$FREQ$ICB STRUCTURE(
            MODE BYTE,
            NUM$CH BYTE,
            DELM$CH BYTE,
            DELM$MASK ADDRESS,
            ECHO$ROW BYTE,
            ECHO$COL BYTE,
            SW$ENABLE ADDRESS)
            DATA(NO$CLEAR$DIGIT,4,'.',2000H,2,7,.SUBMODE$LAST$STEP$ENABLE);


50  2     DISPLAY$STATUS: PROCEDURE;
51  3     DECLARE MODE$TEXT(7) STRUCTURE(CHS(6) BYTE) DATA(
            '      ','T/R   ','T/R+G ','HOM   ','RETRAN','      ','FAIL  ');

52  3       I = SHR(VHF$STATUS,5) AND 1;
53  3       CALL UPDATE$LINE(1,0,3,.OFF$ON$TEXT(3*I));
54  3       I = VHF$STATUS AND 0FH;
55  3       IF I = 5 THEN I = I + (SHR(VHF$STATUS,4) AND 1);
57  3       CALL UPDATE$LINE(1,5,6,.MODE$TEXT(I));
58  3     END;  /* OF DISPLAY$STATUS */

59  2     UPDATE$MODE: PROCEDURE;
60  3     DECLARE SW$LIST(6) BYTE DATA(300,320,340,350,360,440);

61  3       I = 0;
62  3       DO WHILE (SW <> SW$LIST(I)) AND (I < 6);
63  4         I = I + 1;
64  4         END;
65  3       IF I < 6 THEN I = I + 1;
67  3       VHF$STATUS = (VHF$STATUS AND 0F0H) + I;
68  3     END;

69  2     ON$OFF: PROCEDURE;

70  3       IF SW = OFF$SW
              THEN VHF$STATUS = VHF$STATUS AND 0DFH;   /* OFF */
72  3         ELSE VHF$STATUS = VHF$STATUS OR 20H;     /* ON */
73  3       CALL DISPLAY$STATUS;
74  3     END;
```

```
                $EJECT
 75   2         DECLARE VHF$SUBMODE$TABLEAU(*) BYTE DATA(
                   ROW0,'FM ',
                   ROW3,' CHAN MAN  PRST STAT',
                   ROW4,' SEL',COL6,'FREQ',COL11,'CHAN PAGE',
                   ROW5,' T/R',COL6,'T/R+ HOM',COL17,'RE',
                   ROW6,COL6,'GARD',COL16,'TRAN',
                   ROW7,COL11,'TEST',0);
 76   2         DECLARE VHF$SW$ENABLE STRUCTURE(
                   SW$MASK(7) BYTE,
                   SW$VALUE(8) BYTE) DATA(
                   0,0,0EEH,0AEH,3,18H,10H,    /* MASK DATA */
                   00H,12H,33H,44H,44H,44H,55H,60H); /* VALUE DATA */
 77   2         DECLARE VHF$ICB STRUCTURE(
                   MODE BYTE,
                   NUM$CH BYTE,
                   DELM$CH BYTE,
                   DELM$MASK ADDRESS,
                   ECHO$ROW BYTE,
                   ECHO$COL BYTE,
                   SW$ENABLE ADDRESS) DATA(
                   SWITCH,0,0,0,0,0,.VHF$SW$ENABLE);

 78   2         DECLARE VHF$LABEL(3) BYTE AT(.VHF$SUBMODE$TABLEAU(1));
 79   2         DECLARE VHF$CNTL STRUCTURE(
                   LABEL$PTR ADDRESS,
                   ACTIVE$CHAN$PTR ADDRESS,
                   LAST$ACTIVE$CHAN$PTR ADDRESS,
                   FREQ$PTR ADDRESS,
                   FREQ$SIZE BYTE,
                   INSERT$MASK ADDRESS,
                   MIN$PTR ADDRESS,
                   MAX$PTR ADDRESS,
                   MAN$FREQ$ICB$PTR ADDRESS) DATA(
                   .VHF$LABEL,.VHF$ACTIVE$CHAN,.LAST$VHF$ACTIVE$CHAN,.VHF$FREQ,4,2000H,
                   .MIN$FREQ,.MAX$FREQ,.MAN$FREQ$ICB);
```

```
          $EJECT
 80  2        CALL INITIALIZE$COM(.VHF$CNTL);
 81  2        DO FOREVER;
 82  3          CALL CLEAR(0);
 83  3          CALL GRID(.SUBMODE$GRID);
 84  3          CALL DISPLAY(.VHF$SUBMODE$TABLEAU);
 85  3          CALL DISPLAY$CHAN$FREQ(VHF$ACTIVE$CHAN);
 86  3          CALL DISPLAY$STATUS;
 87  3          CALL READ(.VHF$ICB);
 88  3          DO CASE SW$INDEX;
 89  4            CALL CHAN$SEL;
 90  4            CALL MAN$FREQ(VHF$ACTIVE$CHAN);
 91  4            CALL PRST$CHAN;
 92  4            CALL STAT$PAGE;
 93  4            CALL UPDATE$MODE;
 94  4            CALL ON$OFF;
 95  4            CALL SWAP(.VHF$ACTIVE$CHAN, .LAST$VHF$ACTIVE$CHAN); /* LAST */
 96  4            END;    /* OF DO CASE */
 97  3          END;  /* OF DO FOREVER */

 98  2      END;   /* OF VHF$SUBMODE */

 99  1      END;   /* OF VHF */


MODULE INFORMATION:

    CODE AREA SIZE     = 0247H    583D
    VARIABLE AREA SIZE = 0001H      1D
    MAXIMUM STACK SIZE = 000AH     10D
    224 LINES READ
    0 PROGRAM ERROR(S)

END OF PL/M-80 COMPILATION
```

```
ISIS-II PL/M-80 V3.1 COMPILATION OF MODULE UHF
OBJECT MODULE PLACED IN :F1:UHF.OBJ
COMPILER INVOKED BY:  PLM80 :F1:UHF.SRC DATE (30OCT79) DEBUG


                $TITLE('UHF')
  1             UHF: DO;
                $NOLIST INCLUDE(:F1:CDULIT.SRC)
  4  1          INITIALIZE$COM: PROCEDURE(CNTL$PTR) EXTERNAL;
  5  2          DECLARE CNTL$PTR ADDRESS;
  6  2          END;
  7  1          CHAN$SEL: PROCEDURE EXTERNAL;
  8  2          END;
  9  1          MAN$FREQ: PROCEDURE(CHAN) EXTERNAL;
 10  2          DECLARE CHAN BYTE;
 11  2          END;
 12  1          PRST$CHAN: PROCEDURE EXTERNAL;
 13  2          END;
 14  1          STAT$PAGE: PROCEDURE EXTERNAL;
 15  2          END;
 16  1          DISPLAY$CHAN$FREQ: PROCEDURE(CHAN) EXTERNAL;
 17  2          DECLARE CHAN BYTE;
 18  2          END;
 19  1          CLEAR: PROCEDURE(START$ROW) EXTERNAL;
 20  2          DECLARE START$ROW BYTE;
 21  2          END;
 22  1          GRID: PROCEDURE(POINTER) EXTERNAL;
 23  2          DECLARE POINTER ADDRESS;
 24  2          END;
 25  1          DISPLAY: PROCEDURE(IN$PTR) EXTERNAL;
 26  2          DECLARE IN$PTR ADDRESS;
 27  2          END;
 28  1          READ: PROCEDURE(ICB$PTR) EXTERNAL;
 29  2          DECLARE ICB$PTR ADDRESS;
 30  2          END;
 31  1          UPDATE$LINE: PROCEDURE(ROW,COL,NCHAR,TEXT$PTR) EXTERNAL;
 32  2          DECLARE (ROW,COL,NCHAR) BYTE, TEXT$PTR ADDRESS;
 33  2          END;
 34  1          SWAP: PROCEDURE(A, B) EXTERNAL;
 35  2          DECLARE (A, B) ADDRESS;
 36  2          END;

                /* EXTERNAL VARIABLES */
 37  1          DECLARE
                   OFF$ON$TEXT(6) BYTE EXTERNAL,
                   BLANK$LINE(24) BYTE EXTERNAL,
                   SW BYTE EXTERNAL,
                   SW$INDEX BYTE EXTERNAL,
                   UHF$ACTIVE$CHAN BYTE EXTERNAL,
                   SUBMODE$LAST$STEP$ENABLE ADDRESS EXTERNAL,
                   LAST$UHF$ACTIVE$CHAN BYTE EXTERNAL,
                   UHF$STATUS BYTE EXTERNAL,
                   UHF$FREQ(10) STRUCTURE(DIGITS(6) BYTE) EXTERNAL,
                   SUBMODE$GRID ADDRESS EXTERNAL;
```

```
 38  1      DECLARE I BYTE;
 39  1      DECLARE MIN$FREQ(6) BYTE DATA('225000'),
                MAX$FREQ(6) BYTE DATA('399975');

 40  1      INIT$UHF: PROCEDURE PUBLIC;

 41  2        DO I = 0 TO 9;
 42  3          CALL MOVE(6,.MIN$FREQ,.UHF$FREQ(I));
 43  3          END;
 44  2        UHF$STATUS = 0;
 45  2        UHF$ACTIVE$CHAN = 0;
 46  2        LAST$UHF$ACTIVE$CHAN = 0;
 47  2      END;



 48  1      UHF$SUBMODE: PROCEDURE PUBLIC;

 49  2      DECLARE MAN$FREQ$ICB STRUCTURE(
           MODE BYTE,
           NUM$CH BYTE,
           DELM$CH BYTE,
           DELM$MASK ADDRESS,
           ECHO$ROW BYTE,
           ECHO$COL BYTE,
           SW$ENABLE ADDRESS) DATA(
           MO$CLEAR$DIGIT,6,'.',1000H,2,7,.SUBMODE$LAST$STEP$ENABLE);

 50  2      DISPLAY$STATUS: PROCEDURE;
 51  3      DECLARE MODE$TEXT(5) STRUCTURE(CHS(5) BYTE) DATA(
           '    ','T/R  ','T/R+G','ADF  ','GARD ');

 52  3        CALL UPDATE$LINE(1,0,3,.OFF$ON$TEXT(3*(SHR(UHF$STATUS,5) AND 1)));
 53  3        CALL UPDATE$LINE(1,5,5,.MODE$TEXT(UHF$STATUS AND 0FH));
 54  3        IF (UHF$STATUS AND 10H) > 0
                THEN CALL UPDATE$LINE(0,5,3,.('SQL'));
 56  3             ELSE CALL UPDATE$LINE(0,5,3,.BLANK$LINE);
 57  3      END;   /* OF DISPLAY$STATUS */


 58  2      UPDATE$MODE: PROCEDURE;
 59  3      DECLARE SWV$LIST(5) BYTE DATA(300,320,340,350,360);

 60  3        I = 0;
 61  3        DO WHILE (SWV <> SWV$LIST(I)) AND (I < 5);
 62  4          I = I + 1;
 63  4          END;
 64  3        IF I < 4 THEN I = I + 1;
 66  3        UHF$STATUS = (UHF$STATUS AND 0F0H) + I;
 67  3      END;


 68  2      SQL$ON$OFF: PROCEDURE;
 69  3        IF SWV = SQL$OFF$SW
                THEN UHF$STATUS = UHF$STATUS AND 0EFH;
 71  3             ELSE UHF$STATUS = UHF$STATUS OR 10H;
```

```
 72  3      END;

 73  2      TEST$TONE: PROCEDURE;
 74  3        ;
 75  3      END;

 76  2      ON$OFF: PROCEDURE;
 77  3        IF SWV = OFF$SW
             THEN UHF$STATUS = UHF$STATUS AND 0DFH;   /* OFF */
 79  3             ELSE UHF$STATUS = UHF$STATUS OR 20H;    /* ON */
 80  3      END;


 81  2      DECLARE UHF$SUBMODE$TABLEAU(*) BYTE DATA(
             ROW0,'UHF',
             ROW3,' CHAN MAN  PRST STAT',
             ROW4,' SEL',COL6,'FREQ',COL11,'CHAN PAGE',
             ROW5,' T/R',COL6,'T/R+ ADF',COL16,'GARD',
             ROW6,COL6,'GARD',
             ROW7,' SQL',COL6,'SQL',COL11,'TEST',
             ROW8,' OFF',COL6,'ON',COL11,'TONE',0);
 82  2      DECLARE UHF$SW$ENABLE STRUCTURE(
             SW$MASK(7) BYTE,
             SW$VALUE(9) BYTE) DATA(
             0,0,0EEH,0AEH,0A8H,18H,10H, /* MASK DATA */
             00H,12H,33H,44H,44H,45H,56H,77H,80H);
 83  2      DECLARE UHF$ICB STRUCTURE(
             MODE BYTE,
             NUM$CH BYTE,
             DELM$CH BYTE,
             DELM$MASK ADDRESS,
             ECHO$ROW BYTE,
             ECHO$COL BYTE,
             SW$ENABLE ADDRESS) DATA(
             SWITCH,0,0,0,0,0,.UHF$SW$ENABLE);

 84  2      DECLARE UHF$LABEL(3) BYTE AT(.UHF$SUBMODE$TABLEAU(1));
 85  2      DECLARE UHF$CNTL STRUCTURE(
             LABEL$PTR ADDRESS,
             ACTIVE$CHAN$PTR ADDRESS,
             LAST$ACTIVE$CHAN$PTR ADDRESS,
             FREQ$PTR ADDRESS,
             FREQ$SIZE BYTE,
             INSERT$MASK ADDRESS,
             MIN$PTR ADDRESS,
             MAX$PTR ADDRESS,
             MAN$FREQ$ICB$PTR ADDRESS) DATA(
             .UHF$LABEL,.UHF$ACTIVE$CHAN,.LAST$UHF$ACTIVE$CHAN,.UHF$FREQ,6,1000H,
             .MIN$FREQ,.MAX$FREQ,.MAN$FREQ$ICB);
```

```
            $EJECT
 86   2        CALL INITIALIZE$COM(.UHF$CNTL);
 87   2        DO FOREVER;
 88   3          CALL CLEAR(0);
 89   3          CALL GRID(.SUBMODE$GRID);
 90   3          CALL DISPLAY(.UHF$SUBMODE$TABLEAU);
 91   3          CALL DISPLAY$CHAN$FREQ(UHF$ACTIVE$CHAN);
 92   3          CALL DISPLAY$STATUS;
 93   3          CALL READ(.UHF$ICB);
 94   3          DO CASE SW$INDEX;
 95   4            CALL CHAN$SEL;
 96   4            CALL MAN$FREQ(UHF$ACTIVE$CHAN);
 97   4            CALL PRST$CHAN;
 98   4            CALL STAT$PAGE;
 99   4            CALL UPDATE$MODE;   /* T/R, T/R+G, ADF, GARD */
100   4            CALL SQL$ON$OFF;
101   4            CALL TEST$TONE;
102   4            CALL ON$OFF;
103   4            CALL SWAP(.UHF$ACTIVE$CHAN, .LAST$UHF$ACTIVE$CHAN); /* LAST */
104   4            END;    /* OF DO CASE */
105   3          END;  /* OF DO FOREVER */

106   2      END;   /* OF UHF$SUBMODE */

107   1      END;   /* OF UHF */



MODULE INFORMATION:

    CODE AREA SIZE     = 0296H    646D
    VARIABLE AREA SIZE = 0001H      1D
    MAXIMUM STACK SIZE = 0008H      8D
    239 LINES READ
    0 PROGRAM ERROR(S)

END OF PL/M-80 COMPILATION
```

```
ISIS-II PL/M-80 V3.1 COMPILATION OF MODULE ADF
OBJECT MODULE PLACED IN :F1:ADF.OBJ
COMPILER INVOKED BY:  PLM80 :F1:ADF.SRC DATE(30OCT79) DEBUG


                $TITLE('ADF')
  1             ADF: DO;
                $NOLIST INCLUDE(:F1:COLIT.SRC)
  4   1         INITIALIZE$COM: PROCEDURE(CNTL$PTR) EXTERNAL;
  5   2         DECLARE CNTL$PTR ADDRESS;
  6   2         END;
  7   1         CHAN$SEL: PROCEDURE EXTERNAL;
  8   2         END;
  9   1         MAN$FREQ: PROCEDURE(CHAN) EXTERNAL;
 10   2         DECLARE CHAN BYTE;
 11   2         END;
 12   1         PRST$CHAN: PROCEDURE EXTERNAL;
 13   2         END;
 14   1         STAT$PAGE: PROCEDURE EXTERNAL;
 15   2         END;
 16   1         DISPLAY$CHAN$FREQ: PROCEDURE(CHAN) EXTERNAL;
 17   2         DECLARE CHAN BYTE;
 18   2         END;
 19   1         CLEAR: PROCEDURE(START$ROW) EXTERNAL;
 20   2         DECLARE START$ROW BYTE;
 21   2         END;
 22   1         CLEAR$TEMP$BUF: PROCEDURE EXTERNAL;
 23   2         END;
 24   1         GRID: PROCEDURE(POINTER) EXTERNAL;
 25   2         DECLARE POINTER ADDRESS;
 26   2         END;
 27   1         DISPLAY: PROCEDURE(IN$PTR) EXTERNAL;
 28   2         DECLARE IN$PTR ADDRESS;
 29   2         END;
 30   1         READ: PROCEDURE(ICB$PTR) EXTERNAL;
 31   2         DECLARE ICB$PTR ADDRESS;
 32   2         END;
 33   1         UPDATE$LINE: PROCEDURE(ROW,COL,NCHAR,TEXT$PTR) EXTERNAL;
 34   2         DECLARE (ROW,COL,NCHAR) BYTE, TEXT$PTR ADDRESS;
 35   2         END;
 36   1         SWAP: PROCEDURE(A, B) EXTERNAL;
 37   2         DECLARE (A, B) ADDRESS;
 38   2         END;

                /* EXTERNAL VARIABLES */
 39   1         DECLARE
                   OFF$ON$TEXT(6) BYTE EXTERNAL,
                   BLANK$LINE(24) BYTE EXTERNAL,
                   TEMP$BUF(24) BYTE EXTERNAL,
                   SUBMODE$LAST$STEP$ENABLE ADDRESS EXTERNAL,
                   SMV BYTE EXTERNAL,
                   SM$INDEX BYTE EXTERNAL,
                   ADF$ACTIVE$CHAN BYTE EXTERNAL,
                   LAST$ADF$ACTIVE$CHAN BYTE EXTERNAL,
                   ADF$STATUS BYTE EXTERNAL,
                   ADF$FREQ(10) STRUCTURE(DIGITS(4) BYTE) EXTERNAL,
```

```
                SUBMODE$GRID ADDRESS EXTERNAL;

 40  1      DECLARE CW$SW LITERALLY '420';
 41  1      DECLARE I BYTE;
 42  1      DECLARE MIN$FREQ(4) BYTE DATA('0190'),
                 MAX$FREQ(4) BYTE DATA('1750');

 43  1      INIT$ADF: PROCEDURE PUBLIC;

 44  2        DO I = 0 TO 9;
 45  3          CALL MOVE(4,.MIN$FREQ,.ADF$FREQ(I));
 46  3          END;
 47  2        ADF$STATUS = 0;
 48  2        ADF$ACTIVE$CHAN = 0;
 49  2        LAST$ADF$ACTIVE$CHAN = 0;
 50  2      END;



 51  1      ADF$SUBMODE: PROCEDURE PUBLIC;

 52  2      DECLARE MAN$FREQ$ICB STRUCTURE(
                MODE BYTE,
                NUM$CH BYTE,
                DELM$CH BYTE,
                DELM$MASK ADDRESS,
                ECHO$ROW BYTE,
                ECHO$COL BYTE,
                SW$ENABLE ADDRESS) DATA(
                MD$CLEAR$DIGIT,4,0,0,2,7,.SUBMODE$LAST$STEP$ENABLE);



 53  2      DISPLAY$STATUS: PROCEDURE;
 54  3      DECLARE MODE0$TEST$LABEL(3) STRUCTURE(TEXT(4) BYTE)
                DATA('VCE CW      '),
                MODE1$LABEL(3) STRUCTURE(TEXT(8) BYTE)
                DATA('RCVR    AUTO ADFMAN ADF ');

 55  3        CALL UPDATE$LINE(0,5,4,.MODE0$TEST$LABEL(ADF$STATUS AND 3));
 56  3        CALL CLEAR$TEMP$BUF;
 57  3        IF (ADF$STATUS AND 20H) > 0 THEN I = 3;
 59  3                                    ELSE I = 0;
 60  3        CALL MOVE(3,.OFF$ON$TEXT(I),.TEMP$BUF);
 61  3        CALL MOVE(8,.MODE1$LABEL(SHR(ADF$STATUS,2) AND 3),.TEMP$BUF(5));
 62  3        CALL UPDATE$LINE(1,0,13,.TEMP$BUF);
 63  3      END;   /* OF DISPLAY$STATUS */

 64  2      UPDATE$MODE1: PROCEDURE;
 65  3      DECLARE SW$LIST(4) BYTE DATA(300,310,320,340),
                VAL$LIST(4) BYTE DATA(0,0,4,8);

 66  3        I = 0;
 67  3        DO WHILE (SW$ <> SW$LIST(I)) AND (I < 4);
 68  4          I = I + 1;
 69  4          END;
 70  3        ADF$STATUS = (ADF$STATUS AND 0F3H) + VAL$LIST(I);
```

```
 71  3      END;


 72  2      UPDATE$MODE$W: PROCEDURE;
 73  3        ADF$STATUS = ADF$STATUS AND 0FCH;
 74  3        IF SWV = CW$SW THEN ADF$STATUS = ADF$STATUS + 1;
 76  3      END;

 77  2      TEST: PROCEDURE;
 78  3        ADF$STATUS = (ADF$STATUS AND 0FCH) + 2;
 79  3      END;

 80  2      ON$OFF: PROCEDURE;
 81  3        IF SWV = OFF$SW
                THEN ADF$STATUS = ADF$STATUS AND 0DFH;   /* OFF */
 83  3             ELSE ADF$STATUS = ADF$STATUS OR 20H;    /* ON */
 84  3      END;


 85  2      DECLARE ADF$SUBMODE$TABLEAU(*) BYTE DATA(
                ROW0,'ADF',
                ROW3,' CHAN MAN',COL11,'PRST STAT',
                ROW4,' SEL',COL6,'FREQ',COL11,'CHAN PAGE',
                ROW5,' RCVR AUTO MAN',
                ROW6,COL6,'ADF',COL11,'ADF',
                ROW8,' VCE',COL7,'CW',COL11,'TEST',0);
 86  2      DECLARE ADF$SW$ENABLE STRUCTURE(
                SW$MASK(7) BYTE,
                SW$VALUE(9) BYTE) DATA(
                0,0,0EEH,0E8H,0E8H,18H,10H,
                00H,12H,33H,44H,44H,55H,56H,77H,80H);
 87  2      DECLARE ADF$ICB STRUCTURE(
                MODE BYTE,
                NUM$CH BYTE,
                DELM$CH BYTE,
                DELM$MASK ADDRESS,
                ECHO$ROW BYTE,
                ECHO$COL BYTE,
                SW$ENABLE ADDRESS) DATA(
                SWITCH,0,0,0,0,0,.ADF$SW$ENABLE);

 88  2      DECLARE ADF$LABEL(3) BYTE AT(.ADF$SUBMODE$TABLEAU(1));
 89  2      DECLARE ADF$CNTL STRUCTURE(
                LABEL$PTR ADDRESS,
                ACTIVE$CHAN$PTR ADDRESS,
                LAST$ACTIVE$CHAN$PTR ADDRESS,
                FREQ$PTR ADDRESS,
                FREQ$SIZE BYTE,
                INSERT$MASK ADDRESS,
                MIN$PTR ADDRESS,
                MAX$PTR ADDRESS,
                MAN$FREQ$ICB$PTR ADDRESS) DATA(
                .ADF$LABEL,.ADF$ACTIVE$CHAN,.LAST$ADF$ACTIVE$CHAN,.ADF$FREQ,4,0,
                .MIN$FREQ,.MAX$FREQ,.MAN$FREQ$ICB);
```

```
            $EJECT
 90    2        CALL INITIALIZE$COM(.ADF$CNTL);
 91    2        DO FOREVER;
 92    3          CALL CLEAR(0);
 93    3          CALL GRID(.SUBMODE$GRID);
 94    3          CALL DISPLAY(.ADF$SUBMODE$TABLEAU);
 95    3          CALL DISPLAY$CHAN$FREQ(ADF$ACTIVE$CHAN);
 96    3          CALL DISPLAY$STATUS;
 97    3          CALL READ(.ADF$ICB);
 98    3          DO CASE SW$INDEX;
 99    4            CALL CHAN$SEL;
100    4            CALL MAN$FREQ(ADF$ACTIVE$CHAN);
101    4            CALL PRST$CHAN;
102    4            CALL STAT$PAGE;
103    4            CALL UPDATE$MODE1;
104    4            CALL UPDATE$MODE0;
105    4            CALL TEST;
106    4            CALL ON$OFF;
107    4            CALL SWAP(.ADF$ACTIVE$CHAN, .LAST$ADF$ACTIVE$CHAN); /* LAST */
108    4            END;    /* OF DO CASE */
109    3          END;  /* OF DO FOREVER */

110    2      END;   /* OF ADF$SUBMODE */

111    1      END;   /* OF ADF */


MODULE INFORMATION:

    CODE AREA SIZE     = 028BH    651D
    VARIABLE AREA SIZE = 0001H      1D
    MAXIMUM STACK SIZE = 0008H      8D
    244 LINES READ
    0 PROGRAM ERROR(S)

END OF PL/M-80 COMPILATION
```

```
ISIS-II PL/M-80 V3.1 COMPILATION OF MODULE CNV
OBJECT MODULE PLACED IN :F1:CNV.OBJ
COMPILER INVOKED BY:  PLM80 :F1:CNV.SRC DATE(30OCT79) DEBUG


                $TITLE('CNV')
  1             CNV: DO;
                $NOLIST INCLUDE(:F1:COLLIT.SRC)
  4   1         INITIALIZE$COM: PROCEDURE(CNTL$PTR) EXTERNAL;
  5   2         DECLARE CNTL$PTR ADDRESS;
  6   2         END;
  7   1         CHAN$SEL: PROCEDURE EXTERNAL;
  8   2         END;
  9   1         MAN$FREQ: PROCEDURE(CHAN) EXTERNAL;
 10   2         DECLARE CHAN BYTE;
 11   2         END;
 12   1         PRST$CHAN: PROCEDURE EXTERNAL;
 13   2         END;
 14   1         STAT$PAGE: PROCEDURE EXTERNAL;
 15   2         END;
 16   1         DISPLAY$CHAN$FREQ: PROCEDURE(CHAN) EXTERNAL;
 17   2         DECLARE CHAN BYTE;
 18   2         END;
 19   1         CLEAR: PROCEDURE(START$ROW) EXTERNAL;
 20   2         DECLARE START$ROW BYTE;
 21   2         END;
 22   1         CLEAR$TEMP$BUF: PROCEDURE EXTERNAL;
 23   2         END;
 24   1         GRID: PROCEDURE(POINTER) EXTERNAL;
 25   2         DECLARE POINTER ADDRESS;
 26   2         END;
 27   1         DISPLAY: PROCEDURE(IN$PTR) EXTERNAL;
 28   2         DECLARE IN$PTR ADDRESS;
 29   2         END;
 30   1         READ: PROCEDURE(ICB$PTR) EXTERNAL;
 31   2         DECLARE ICB$PTR ADDRESS;
 32   2         END;
 33   1         UPDATE$LINE: PROCEDURE(ROW,COL,NCHAR,TEXT$PTR) EXTERNAL;
 34   2         DECLARE (ROW,COL,NCHAR) BYTE, TEXT$PTR ADDRESS;
 35   2         END;
 36   1         SWAP: PROCEDURE(A, B) EXTERNAL;
 37   2         DECLARE (A, B) ADDRESS;
 38   2         END;

                /* EXTERNAL VARIABLES */
 39   1         DECLARE
                   OFF$ON$TEXT(6) BYTE EXTERNAL,
                   BLANK$LINE(24) BYTE EXTERNAL,
                   TEMP$BUF(24) BYTE EXTERNAL,
                   SW BYTE EXTERNAL,
                   SUBMODE$LAST$STEP$ENABLE ADDRESS EXTERNAL,
                   SW$INDEX BYTE EXTERNAL,
                   CNV$ACTIVE$CHAN BYTE EXTERNAL,
                   LAST$CNV$ACTIVE$CHAN BYTE EXTERNAL,
                   CNV$STATUS BYTE EXTERNAL,
                   CNV$MB$VOL BYTE EXTERNAL,
```

```
                CNV$NAV$VOL BYTE EXTERNAL,
                CNV$FREQ(10) STRUCTURE(DIGITS(5) BYTE) EXTERNAL,
                SUBMODE$GRID ADDRESS EXTERNAL;

40   1      DECLARE VOL$INC$SW LITERALLY '32Q',
                MB$HIGH$SW LITERALLY '35Q';

41   1      DECLARE I BYTE;
42   1      DECLARE MIN$FREQ(5) BYTE DATA('10800'),
                MAX$FREQ(5) BYTE DATA('11795');
43   1      DECLARE VOL$DATA$PTR ADDRESS,
                VOL BASED VOL$DATA$PTR BYTE;

44   1      INIT$CNV: PROCEDURE PUBLIC;

45   2        DO I = 0 TO 9;
46   3          CALL MOVE(5,.MIN$FREQ,.CNV$FREQ(I));
47   3          END;
48   2        CNV$STATUS = 0;
49   2        CNV$ACTIVE$CHAN = 0;
50   2        LAST$CNV$ACTIVE$CHAN = 0;
51   2        VOL$DATA$PTR = .CNV$MB$VOL;
52   2        CNV$MB$VOL = 0;
53   2        CNV$NAV$VOL = 0;
54   2      END;



55   1      CNV$SUBMODE: PROCEDURE PUBLIC;

56   2      DECLARE MAN$FREQ$ICB STRUCTURE(
                MODE BYTE,
                NUM$CH BYTE,
                DELM$CH BYTE,
                DELM$MASK ADDRESS,
                ECHO$ROW BYTE,
                ECHO$COL BYTE,
                SW$ENABLE ADDRESS) DATA(
                ND$CLEAR$DIGIT,5,',',1000H,2,7,.SUBMODE$LAST$STEP$EN[illegible]LE);




57   2      VOL$ADJUST: PROCEDURE;
58   3        IF SW = VOL$INC$SW THEN VOL = VOL + 1;
60   3                           ELSE VOL = VOL - 1;
61   3      END;   /* OF VOL$ADJUST */

62   2      MB$HIGH$LOW: PROCEDURE;

63   3        IF SW = MB$HIGH$SW THEN CNV$STATUS = CNV$STATUS OR 1;
65   3                           ELSE CNV$STATUS = CNV$STATUS AND 0FEH;
66   3      END;   /* OF MB$HIGH$LOW */

67   2      ON$OFF: PROCEDURE;
68   3        IF SW = OFF$SW
                THEN CNV$STATUS = CNV$STATUS AND 0DFH;   /* OFF */
```

AD-A119 133 LITTON SYSTEMS INC VAN NUYS CALIF DATA SYSTEMS DIV F/G 9/2
CONTROL DISPLAY UNIT PROGRAM.(U)
1978

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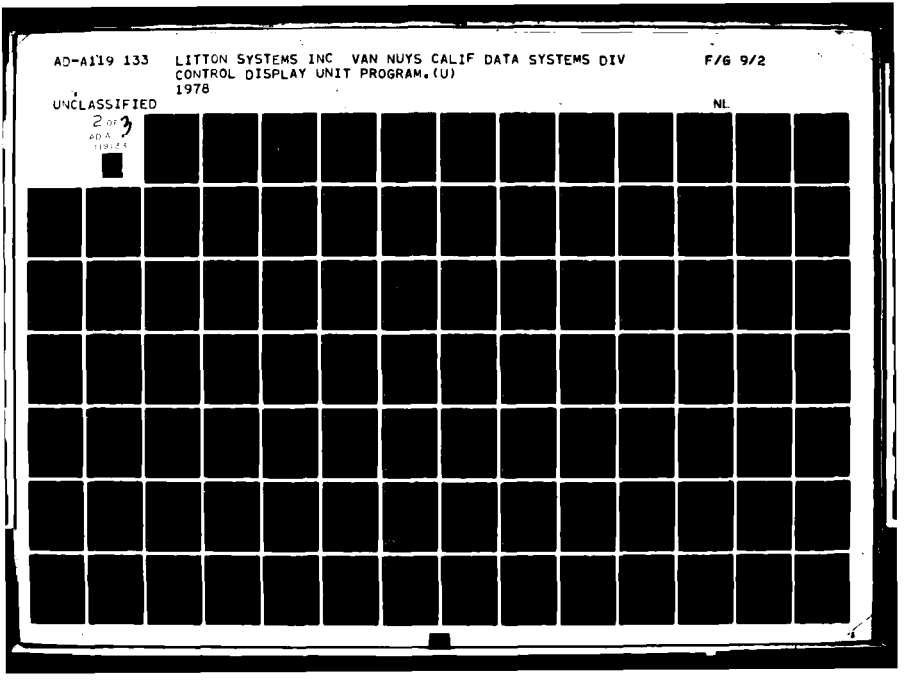


```
70  3           ELSE CNV$STATUS = CNV$STATUS OR 20H;     /* ON */
71  3       END;


72  2       DISPLAY$STATUS: PROCEDURE;
73  3       DECLARE I BYTE;
74  3       DECLARE MB$HILO$TEXT(2) STRUCTURE(CH(5) BYTE) DATA('MB-LO','MB-HI');

75  3          IF (CNV$STATUS AND 20H) > 0 THEN I = 3;
77  3                                      ELSE I = 0;
78  3          CALL UPDATE$LINE(1,0,3,.OFF$ON$TEXT(I));
79  3          CALL UPDATE$LINE(1,19,5,.MB$HILO$TEXT(CNV$STATUS AND 1));
80  3       END;

81  2       DECLARE CNV$SUBMODE$TABLEAU(*) BYTE DATA(
             ROW0,'CNV',
             ROW3,' CHAN MAN',COL11,'PRST STAT',
             ROW4,' SEL',COL6,'FREQ',COL11,'CHAN PAGE',
             ROW5,COL2,'MB',COL6,'INC',COL17,'MB',
             ROW6,' VOL',COL6,'VOL',COL17,'HI',
             ROW7,' NAV',COL6,'DEC',COL17,'MB',
             ROW8,' VOL',COL6,'VOL',COL11,'TEST LOW',0);
82  2       DECLARE CNV$SW$ENABLE STRUCTURE(
             SW$MASK(7) BYTE,
             SW$VALUE(8) BYTE) DATA(
             0,0,0EEH,0A4H,0ACH,13H,10H,
             00H,12H,33H,45H,67H,58H,69H,9AH);
83  2       DECLARE CNV$ICB STRUCTURE(
             MODE BYTE,
             NUM$CH BYTE,
             DELIM$CH BYTE,
             DELIM$MASK ADDRESS,
             ECHO$ROW BYTE,
             ECHO$COL BYTE,
             SWENABLE ADDRESS) DATA(SWITCH,0,0,0,0,0,.CNV$SW$ENABLE);

84  2       DECLARE CNV$LABEL(3) BYTE AT(.CNV$SUBMODE$TABLEAU(1));
85  2       DECLARE CNV$CNTL STRUCTURE(
             LABEL$PTR ADDRESS,
             ACTIVE$CHAN$PTR ADDRESS,
             LAST$ACTIVE$CHAN$PTR ADDRESS,
             FREQ$PTR ADDRESS,
             FREQ$SIZE BYTE,
             INSERT$MASK ADDRESS,
             MIN$PTR ADDRESS,
             MAX$PTR ADDRESS,
             MAN$FREQ$ICB$PTR ADDRESS) DATA(
             .CNV$LABEL,.CNV$ACTIVE$CHAN,.LAST$CNV$ACTIVE$CHAN,.CNV$FREQ,5,1000H,
             .MIN$FREQ,.MAX$FREQ,.MAN$FREQ$ICB);
```

```
                $EJECT
 86   2          CALL INITIALIZE$COM(.CNV$CNTL);
 87   2          DO FOREVER;
 88   3            CALL CLEAR(0);
 89   3            CALL GRID(.SUBMODE$GRID);
 90   3            CALL DISPLAY(.CNV$SUBMODE$TABLEAU);
 91   3            CALL DISPLAY$CHAN$FREQ(CNV$ACTIVE$CHAN);
 92   3            CALL DISPLAY$STATUS;
 93   3            CALL READ(.CNV$ICB);
 94   3            DO CASE SW$INDEX;
 95   4              CALL CHAN$SEL;
 96   4              CALL MAN$FREQ(CNV$ACTIVE$CHAN);
 97   4              CALL PRST$CHAN;
 98   4              CALL STAT$PAGE;
 99   4              VOL$DATA$PTR = .CNV$MB$VOL;              /* MB VOL */
100   4              CALL VOL$ADJUST;                       /* INC VOL, DEC VOL */
101   4              CALL MB$HIGH$LOW;                      /* MB HIGH, MB LOW */
102   4              VOL$DATA$PTR = .CNV$NAV$VOL;             /* NAV VOL */
103   4              ;                                    /* TEST */
104   4              CALL ON$OFF;
105   4              CALL SWAP(.CNV$ACTIVE$CHAN, .LAST$CNV$ACTIVE$CHAN); /* LAST */
106   4              END;    /* OF DO CASE */
107   3            END;  /* OF DO FOREVER */

108   2        END;  /* OF CNV$SUBMODE */

109   1        END;  /* OF CNV */



MODULE INFORMATION:

    CODE AREA SIZE     = 023FH    5750
    VARIABLE AREA SIZE = 0004H      4D
    MAXIMUM STACK SIZE = 0008H      8D
    241 LINES READ
    0 PROGRAM ERROR(S)

END OF PL/M-80 COMPILATION
```

```
ISIS-II PL/M-80 V3.0 COMPILATION OF MODULE DAT
OBJECT MODULE PLACED IN :F1:CDUDAT.OBJ
COMPILER INVOKED BY:  PLM80 :F1:CDUDAT.SRC DATE(19DEC78) DEBUG


          $TITLE('CDUDAT')
  1       DAT: DO;
  2  1    DECLARE
            VHF$ACTIVE$CHAN BYTE PUBLIC,
            LAST$VHF$ACTIVE$CHAN BYTE PUBLIC,
            VHF$STATUS BYTE PUBLIC,
            VHF$FREQ(10) STRUCTURE(DIGITS(4) BYTE) PUBLIC;

  3  1    DECLARE UHF$ACTIVE$CHAN BYTE PUBLIC,
            LAST$UHF$ACTIVE$CHAN BYTE PUBLIC,
            UHF$STATUS BYTE PUBLIC,
            UHF$FREQ(10) STRUCTURE(DIGITS(6) BYTE) PUBLIC;

  4  1    DECLARE ADF$ACTIVE$CHAN BYTE PUBLIC,
            LAST$ADF$ACTIVE$CHAN BYTE PUBLIC,
            ADF$STATUS BYTE PUBLIC,
            ADF$FREQ(10) STRUCTURE(DIGITS(4) BYTE) PUBLIC;

  5  1    DECLARE CNV$ACTIVE$CHAN BYTE PUBLIC,
            LAST$CNV$ACTIVE$CHAN BYTE PUBLIC,
            CNV$STATUS BYTE PUBLIC,
            CNV$$$$$$$$L BYTE PUBLIC,
            CNV$$$$$$$$L BYTE PUBLIC,
            CNV$FREQ(10) STRUCTURE(DIGITS(5) BYTE) PUBLIC;

  6  1    DECLARE DFF$STATUS BYTE PUBLIC,
            DFF$$$$$$$E BYTE PUBLIC,
            DFF$$$TE$$$$$POSITION BYTE PUBLIC,
          /* DFF INITIALIZATION REQUIRES THAT THE FOLLOWING ITEMS BE CONTIGUOUS. */
            DFF$N1$CODE(2) BYTE PUBLIC,
            DFF$N2$CODE(4) BYTE PUBLIC,
            DFF$N3$CODE(4) BYTE PUBLIC;

  7  1    END;  /* DAT */


MODULE INFORMATION:

    CODE AREA SIZE     = 0000H     0D
    VARIABLE AREA SIZE = 0009H   217D
    MAXIMUM STACK SIZE = 0000H     0D
    34 LINES READ
    0 PROGRAM ERROR(S)

END OF PL/M-80 COMPILATION
```

```
ISIS-II PL/M-80 V3.1 COMPILATION OF MODULE FONTDA
OBJECT MODULE PLACED IN :F1:FONTDA.OBJ
COMPILER INVOKED BY:  PLM80 :F1:FONTDA.SRC DATE(27OCT79) DEBUG


          $TITLE('FONTDA')
  1        FONTDA: DO;
  2  1     DECLARE CHSFONT$DATA(320) BYTE PUBLIC DATA(
             0,0,0,0,0,  /* SP */
             0,0,5FH,0,0,        /* ! */
             6,9,9,6,0,      /* DEG SYM */
             0,7FH,3EH,1CH,8,    /* SOLID RIGHT ARROW */
             0,0CH,2AH,77H,2AH,  /* $ */
             0,63H,13H,8H,64H,   /* % */
             0,36H,49H,56H,20H,  /* & */
             0,0,0,7,0,      /* ' */
             0,0,1CH,22H,41H,    /* ( */
             0,0,41H,22H,1CH,    /* ) */
             2AH,1CH,3EH,1CH,2AH,    /* * */
             8,8,3EH,8,8,        /* + */
             0,40H,30H,0,0,      /* , */
             8,8,8,8,8,      /* - */
             0,60H,60H,0,0,      /* . */
             60H,10H,8,4,3,      /* / */
             3EH,51H,49H,45H,3EH,    /* 0 */
             44H,42H,7FH,40H,40H,    /* 1 */
             72H,49H,49H,49H,46H,    /* 2 */
             22H,41H,49H,49H,36H,    /* 3 */
             18H,14H,12H,7FH,10H,    /* 4 */
             27H,45H,45H,45H,39H,    /* 5 */
             3CH,4AH,49H,49H,30H,    /* 6 */
             61H,11H, 9, 5, 3,   /* 7 */
             36H,49H,49H,49H,36H,    /* 8 */
             46H,49H,49H,29H,1EH,    /* 9 */
             0,36H,36H,0,0,      /* : */
             0,46H,36H,0,0,      /* ; */
             8,14H,22H,41H,0,    /* < */
             14H,14H,14H,14H,14H,    /* = */
             0,41H,22H,14H,8,    /* > */
             2,1,51H,9H,6,       /* ? */
             3EH,41H,5DH,55H,2EH,    /* @ */
             7CH,12H,11H,12H,7CH,    /* A */
             7FH,49H,49H,49H,36H,    /* B */
             3EH,41H,41H,41H,22H,    /* C */
             7FH,41H,41H,22H,1CH,    /* D */
             7FH,49H,49H,49H,41H,    /* E */
             7FH,9,9,9,1,        /* F */
             3EH,41H,51H,51H,72H,    /* G */
             7FH,8,8,8,7FH,      /* H */
             0,41H,7FH,41H,0,    /* I */
             20H,40H,41H,3FH,1,  /* J */
             7FH,8,14H,22H,41H,  /* K */
             7FH,40H,40H,40H,40H,    /* L */
             7FH,2,0CH,2,7FH,        /* M */
             7FH,6,0CH,18H,7FH,  /* N */
             3EH,41H,41H,41H,3EH,    /* O */
```

```
                7FH,9,9,9,6,        /* P */
                3EH,41H,51H,21H,5EH,    /* Q */
                7FH,9,19H,29H,46H,  /* R */
                22H,45H,49H,51H,22H,    /* S */
                1,1,7FH,1,1,        /* T */
                3FH,40H,40H,40H,3FH,    /* U */
                7,18H,60H,18H,7,    /* V */
                7FH,20H,1CH,20H,7FH,    /* W */
                63H,14H,8,14H,63H,  /* X */
                3,4,78H,4,3,        /* Y */
                61H,51H,49H,45H,43H,    /* Z */
                )1

  3  1      END;  /* OF COUDAT */
```

MODULE INFORMATION:

```
    CODE AREA SIZE     = 0140H   320D
    VARIABLE AREA SIZE = 0000H     0D
    MAXIMUM STACK SIZE = 0000H     0D
    65 LINES READ
    0 PROGRAM ERROR(S)

END OF PL/M-80 COMPILATION
```

```
ISIS-II PL/M-80 V3.1 COMPILATION OF MODULE IFF
OBJECT MODULE PLACED IN :F1:IFF.OBJ
COMPILER INVOKED BY:  PLM80 :F1:IFF.SRC DATE(29OCT79) DEBUG


                $TITLE('IFF')
 1              IFF: DO;
                $NOLIST INCLUDE(:F1:CRULIT.SRC)
 4   1          ERROR: PROCEDURE(CODE) EXTERNAL;
 5   2          DECLARE CODE BYTE;
 6   2          END;
 7   1          CLEAR$LINE: PROCEDURE(LINE) EXTERNAL;
 8   2          DECLARE LINE BYTE;
 9   2          END;
10   1          CLEAR: PROCEDURE(START$ROW) EXTERNAL;
11   2          DECLARE START$ROW BYTE;
12   2          END;
13   1          CLEAR$TEMP$BUF: PROCEDURE EXTERNAL;
14   2          END;
15   1          GRID: PROCEDURE(POINTER) EXTERNAL;
16   2          DECLARE POINTER ADDRESS;
17   2          END;
18   1          DISPLAY: PROCEDURE(IN$PTR) EXTERNAL;
19   2          DECLARE IN$PTR ADDRESS;
20   2          END;
21   1          READ: PROCEDURE(ICB$PTR) EXTERNAL;
22   2          DECLARE ICB$PTR ADDRESS;
23   2          END;
24   1          LIMIT$TEST: PROCEDURE(BUF$PTR,NUM$DIGITS,MIN$PTR,MAX$PTR) BYTE EXTERNAL;
25   2          DECLARE NUM$DIGITS BYTE, (BUF$PTR,MIN$PTR,MAX$PTR) ADDRESS;
26   2          END;
27   1          UPDATE$LINE: PROCEDURE(ROW,COL,NCHAR,TEXT$PTR) EXTERNAL;
28   2          DECLARE (ROW,COL,NCHAR) BYTE, TEXT$PTR ADDRESS;
29   2          END;
30   1          RAD$TEST: PROCEDURE;
31   2             ;
32   2          END;

33   1          DECLARE NORM$SW LITERALLY '320';

                /* EXTERNAL VARIABLES */
34   1          DECLARE
                   OFF$ON$TEXT(2) STRUCTURE(CHAR(3) BYTE) EXTERNAL,
                   BLANK$LINE(24) BYTE EXTERNAL,
                   TEMP$BUF(24) BYTE EXTERNAL,
                   SW BYTE EXTERNAL,
                   SW$INDEX BYTE EXTERNAL,
                   IN$BUF(16) BYTE EXTERNAL,
                   DATA$ENTERED BYTE EXTERNAL,
                   DIGIT$KB$GRID ADDRESS EXTERNAL,
                   OCTAL$KB$TABLEAU ADDRESS EXTERNAL,
                   IFF$STATUS BYTE EXTERNAL,
                   IFF$M1$CODE(2) BYTE EXTERNAL,
                   IFF$MC$CODE(4) BYTE EXTERNAL,
                   IFF$M3$CODE(4) BYTE EXTERNAL,
                   IFF$M4$MODE BYTE EXTERNAL,
```

```
                IFF$ANTENNA$POSITION BYTE EXTERNAL,
                SUBMODE$GRID ADDRESS EXTERNAL;

 35  1      DECLARE ON$OFF$SUBMODE$ENABLE STRUCTURE(
                SW$MASK(7) BYTE,
                SW$VALUE(2) BYTE) DATA(
                0,0,0,0,0,18H,80H,  /* OFF, ON, SUBMODE */
                01H,20H);
 36  1      DECLARE GARD$ENABLE STRUCTURE(
                SW$MASK(7) BYTE) DATA(0,0,0,0,0,0,0AOH);    /* VALUE NOT IMPORTANT */
 37  1      DECLARE GARD$ICB STRUCTURE(
                MODE BYTE,
                NUM$CH BYTE,
                DELM$CH BYTE,
                DELM$MASK ADDRESS,
                ECHO$ROW BYTE,
                ECHO$COL BYTE,
                SW$ENABLE ADDRESS) DATA(SWITCH,0,0,0,0,0,.GARD$ENABLE);


 38  1      INIT$IFF: PROCEDURE PUBLIC;
             /* INITIALIZATION OF THE CODE DATA BELOW REQUIRES THAT THE DATA BE
                LOCATED CONTIGUOUSLY AND THAT MI$CODE APPEAR FIRST IN THE LIST
                (HAVE THE LOWEST ADDRESS). */

 39  2          IFF$STATUS = 0;
 40  2          IFF$M4$MODE = 0;
 41  2          IFF$ANTENNA$POSITION = 0;
 42  2          IFF$MI$CODE(0) = '0';
 43  2          CALL MOVE(9,.IFF$MI$CODE,.IFF$MI$CODE + 1);
 44  2      END;


 45  1      INDEX: PROCEDURE(VALUE,BIT$LOC,MASK) BYTE;
 46  2      DECLARE(VALUE,BIT$LOC,MASK) BYTE;

 47  2          RETURN(SHR(VALUE,BIT$LOC) AND MASK);
 48  2      END;


 49  1      DECLARE I BYTE;


 50  1      IFF$ON$OFF: PROCEDURE;

 51  2      IFF$OFF: PROCEDURE;

 52  3          CALL DISPLAY(.(ROW2, 'OFF GARDED',0));
 53  3          CALL READ(.GARD$ICB);
 54  3          IF SW = SUBMODE$SW THEN RETURN;
 56  3          CALL CLEAR$LINE(2);
 57  3          IFF$STATUS = IFF$STATUS AND 0DFH;
 58  3      END;   /* OF IFF$OFF */

 59  2          IF SW = OFF$SW THEN CALL IFF$OFF;
 61  2                         ELSE IFF$STATUS = IFF$STATUS OR 20H;
 62  2      END;
```

```
 63  1    NORM$STBY: PROCEDURE;
 64  2      IF SW# = NORM$SW THEN IFF$STATUS = IFF$STATUS AND 0BFH;
 66  2                       ELSE IFF$STATUS = IFF$STATUS OR 040H;
 67  2    END;
 68  1    TEST: PROCEDURE;
 69  2    DECLARE TEST$TABLEAU(*) BYTE DATA(
            ROW0,COL8,'IFF TEST',
            ROW4,' M-1',COL6,'M-2',COL11,'M-3A',
            ROW6,' M-4',
            ROW8,' M-C',0);
 70  2    DECLARE TEST$ENABLE STRUCTURE(
            SW#MASK(7) BYTE,
            SW#VALUE(3) BYTE) DATA(
            0,0,0A8H,80H,80H,0,80H,
            01H,23H,45H);
 71  2    DECLARE TEST$ICB STRUCTURE(
            MODE BYTE,
            NUM#CH BYTE,
            DELM#CH BYTE,
            DELM#MASK ADDRESS,
            ECHO$ROW BYTE,
            ECHO$COL BYTE,
            SW#ENABLE ADDRESS) DATA(SWITCH,0,0,0,0,0,.TEST$ENABLE);


 72  2      CALL CLEAR(0);
 73  2      IF IFF#M4#MODE THEN TEMP$BUF(0) = 'B';
 75  2                     ELSE TEMP$BUF(0) = 'A';
 76  2      CALL UPDATE$LINE(6,4,1,.TEMP$BUF);
 77  2      CALL CLEAR$TEMP$BUF;
 78  2      CALL MOVE(8,.TEST$TABLEAU + 2,.TEMP$BUF);
 79  2      CALL MOVE(6,.('PASSED'),.TEMP$BUF(11));
 80  2      CALL DISPLAY(.TEST$TABLEAU);
 81  2      CALL GRID(.SUBMODE$GRID);
 82  2      DO FOREVER;
 83  3        CALL READ(.TEST$ICB);
 84  3        IF SW# = SUBMODE$SW THEN RETURN;
 86  3        IF SW#INDEX = 4
              THEN TEMP$BUF(9) = 'C' ;
 88  3          ELSE TEMP$BUF(9) = SW#INDEX + 31H;
 89  3        CALL UPDATE$LINE(2,0,17,.TEMP$BUF);
 90  3        END;  /* OF DO FOREVER */
 91  2    END   /* OF TEST */


 92  1    DISPLAY$SUBMODE$STATUS$LINE: PROCEDURE;
 93  2    DECLARE BUF$PTR ADDRESS,
              (BUF BASED BUF$PTR)(1) BYTE,
              MASK BYTE;
 94  2    DECLARE NORM$STBY$TEXT(2) STRUCTURE(CHAR(4) BYTE) DATA('NORM','STBY');


 95  2      CALL CLEAR$LINE(1);
 96  2      CALL UPDATE$LINE(0,10,4,.NORM$STBY$TEXT(INDEX(IFF$STATUS,6,1)));
 97  2      BUF$PTR = .TEMP$BUF + 4;
 98  2      CALL CLEAR$TEMP$BUF;
```

```
 99  2          CALL MOVE(3,.OFF$ON$TEXT(INDEX(IFF$STATUS,5,1)),.TEMP$BUF);
100  2          MASK = IFF$STATUS;
101  2          DO I = 0 TO 4;
102  3            IF MASK THEN DO;  /* INSERT M<I> TEXT FOR 'ON' UNITS */
104  4              BUF(0) = 'M';
105  4              BUF(1) = I + 31H;
106  4              END;
107  3            BUF$PTR = BUF$PTR + 4;
108  3            MASK = SHR(MASK,1);
109  3            END;  /* OF DO I */
110  2          IF (IFF$STATUS AND 4) > 0 THEN TEMP$BUF(14) = 'A';
112  2          IF (IFF$STATUS AND 8) > 0 THEN DO;
114  3             IF IFF$VM1$MODE THEN TEMP$BUF(18) = 'B';
116  3                             ELSE TEMP$BUF(18) = 'A';
117  3             END;
118  2          IF (IFF$STATUS AND 10H) > 0 THEN TEMP$BUF(21) = 'C';
120  2          CALL UPDATE$LINE(1,0,22,.TEMP$BUF);

121  2        END;  /* OF DISPLAY$SUBMODE$STATUS$LINE */
```

```
                $EJECT
122   1     M4$SELECT: PROCEDURE;
123   2     DECLARE M4$TABLEAU(*) BYTE DATA(
              ROW2,'M-4  SELECT',
              ROW3,COL7,'A',COL13,'B',COL16,'HOLD',
              ROW5,COL6,'AUD',COL11,'AUD',COL16,'OUT',
              ROW6,' M-4',COL11,'LITE',0);
124   2     DECLARE M4$ENABLE STRUCTURE(
              SW$MASK(7) BYTE,
              SW$VALUE(5) BYTE) DATA(
              0,0,2CH,2CH,0,18H,80H,
              01H,23H,45H,67H,89H);
125   2     DECLARE M4$ICB STRUCTURE(
              MODE BYTE,
              NUM$CH BYTE,
              DELM$CH BYTE,
              DELM$MASK ADDRESS,
              ECHO$ROW BYTE,
              ECHO$COL BYTE,
              SW$ENABLE ADDRESS) DATA(SWITCH,0,0,0,0,0,.M4$ENABLE);
126   2     DECLARE HOLD$TEXT(*) BYTE DATA('HOLD');

127   2     DISPLAY$M4$STATUS: PROCEDURE;
128   3     DECLARE AUD$LITE$TEXT(3) STRUCTURE(CHAR(8) BYTE)
                DATA('        ','AUD     ','AUD LITE');

129   3       CALL CLEAR$LINE(1);
130   3       CALL CLEAR$TEMP$BUF;
131   3       IF (IFF$M4$MODE AND 2) > 0 THEN
132   3         CALL MOVE(4,.HOLD$TEXT,.TEMP$BUF(20));
133   3       CALL MOVE(8,.AUD$LITE$TEXT(INDEX(IFF$M4$MODE,2,3)),.TEMP$BUF(6));
134   3       CALL MOVE(3,.OFF$ON$TEXT(INDEX(IFF$STATUS,3,1)),.TEMP$BUF);
135   3       CALL UPDATE$LINE(1,0,24,.TEMP$BUF);
136   3       IF IFF$M4$MODE THEN TEMP$BUF(0) = 'B';
138   3                      ELSE TEMP$BUF(0) = 'A';
139   3       CALL UPDATE$LINE(2,3,1,.TEMP$BUF);
140   3     END;

              /* BEGIN M4$SELECT CODE */
141   2       CALL CLEAR(1);
142   2       CALL GRID(.SUBMODE$GRID);
143   2       CALL DISPLAY(.M4$TABLEAU);
144   2       DO FOREVER;
145   3         CALL DISPLAY$M4$STATUS;
146   3         CALL READ(.M4$ICB);
147   3         DO CASE SW$INDEX;
148   4           IFF$M4$MODE = IFF$M4$MODE AND 0FEH;     /* A */
149   4           IFF$M4$MODE = IFF$M4$MODE OR 1;         /* B */
150   4           IFF$M4$MODE = (IFF$M4$MODE AND 0F1H) OR
                                ((NOT IFF$M4$MODE) AND 2);    /* HOLD */
151   4           IFF$M4$MODE = (IFF$M4$MODE AND 0F3H) OR 4;  /* AUD */
152   4           IFF$M4$MODE = (IFF$M4$MODE AND 0F3H) OR 8;  /* AUD LITE */
153   4           IFF$M4$MODE = IFF$M4$MODE AND 0F3H;     /* OUT */
154   4           IFF$STATUS = IFF$STATUS AND 0F7H;       /* OFF */
155   4           IFF$STATUS = IFF$STATUS OR 8;           /* ON */
156   4           RETURN;                                    /* SUBMODE */
157   4           END;    /* OF DO CASE */
```

```
158  3          END;  /* OF DO FOREVER */
159  2      END;  /* OF M4$SELECT */
```

```
                $EJECT
160   1         DECLARE ANT$TEXT(3) STRUCTURE(CHAR(3) BYTE) DATA('TOPDIVBOT');


161   1         ANT$SELECT: PROCEDURE;
162   2         DECLARE ANT$TABLEAU(*) BYTE DATA(
                     ROW2,'ANT SELECT',
                     ROW4,' TOP',
                     ROW6,' DIV',
                     ROW8,' BOT',0);
163   2         DECLARE ANT$ENABLE STRUCTURE(
                     SW$MASK(7) BYTE,
                     SW$VALUE(3) BYTE) DATA(
                     0,0,0C0H,0C0H,0C0H,0,50H,   /* TOP, DIV, BOT, SUBMODE */
                     00H,11H,22H);
164   2         DECLARE ANT$ICB STRUCTURE(
                     MODE BYTE,
                     NUM$CH BYTE,
                     DELIM$CH BYTE,
                     DELIM$MASK ADDRESS,
                     ECHO$ROW BYTE,
                     ECHO$COL BYTE,
                     SW$ENABLE ADDRESS) DATA(SWITCH,0,0,0,0,0,.ANT$ENABLE);



165   2           CALL CLEAR(2);
166   2           CALL DISPLAY(.ANT$TABLEAU);
167   2           CALL GRID(.SUBMODE$GRID);
168   2           CALL CLEAR$LINE(1);
169   2           CALL UPDATE$LINE(1,20,3,.ANT$TEXT(IFF$ANTENNA$POSITION));
170   2           CALL READ(.ANT$ICB);
171   2           IF SWV = SUBMODE$SW THEN RETURN;
173   2           IFF$ANTENNA$POSITION = SW$INDEX;
174   2         END;   /* OF ANT$SELECT */
```

```
                $EJECT
175   1         MC$ON$OFF: PROCEDURE;
176   2         DECLARE MC$TABLEAU(*) BYTE DATA(
                    ROW2,'M-C ON/OFF',0);
177   2         DECLARE MC$ICB STRUCTURE(
                    MODE BYTE,
                    NUM$CH BYTE,
                    DELIM$CH BYTE,
                    DELIM$MASK ADDRESS,
                    ECHO$ROW BYTE,
                    ECHO$COL BYTE,
                    SW$ENABLE ADDRESS) DATA(SWITCH,0,0,0,0,0,.ON$OFF$SUBMODE$ENABLE);



178   2             CALL CLEAR(1);
179   2             CALL UPDATE$LINE(0,20,4,.BLANK$LINE);
180   2             CALL GRID(.SUBMODE$GRID);
181   2             CALL DISPLAY(.MC$TABLEAU);
182   2             CALL UPDATE$LINE(1,0,3,.OFF$ON$TEXT(INDEX(IFF$STATUS,4,1)));
183   2             CALL READ(.MC$ICB);
184   2             IF SWV = SUBMODE$SW THEN RETURN;
186   2             IF SW$INDEX THEN IFF$STATUS = IFF$STATUS OR 10H;    /* ON */
188   2                         ELSE IFF$STATUS = IFF$STATUS AND 0EFH;  /* OFF */
189   2         END;   /* OF MC$ON$OFF */
```

```
                $EJECT
190   1         CODE$ENTRY: PROCEDURE;
                /* THIS PROCEDURE HANDLES DATA ENTRIES FOR M1, M2, AND M3A CODES. THE
                   SPECIFIC CODE UPDATED IS DETERMINED BY THE VALUE OF SW$INDEX ON ENTRY:
                   SW$INDEX = 0 - M1
                            = 1 - M2
                            = 2 - M3
                */
191   2         DECLARE ENTRY$TABLEAU(*) BYTE DATA(
                   ROW2,'ENTER CODE',0);

192   2         DECLARE INIT$CODE$ICB STRUCTURE(
                   MODE BYTE,
                   NUM$CH BYTE,
                   DELM$CH BYTE,
                   DELM$MASK ADDRESS,
                   ECHO$ROW BYTE,
                   ECHO$COL BYTE,
                   SW$ENABLE ADDRESS) DATA(OCTAL,0,0,0,2,11,.ON$OFF$SUBMODE$ENABLE);
193   2         DECLARE CODE$ICB STRUCTURE(
                   MODE BYTE,
                   NUM$CH BYTE,
                   DELM$CH BYTE,
                   DELM$MASK ADDRESS,
                   ECHO$ROW BYTE,
                   ECHO$COL BYTE,
                   SW$ENABLE ADDRESS);
194   2         DECLARE CODE$TAB(*) BYTE DATA(ROW2,'ENTER CODE',0);
195   2         DECLARE LABEL$TAB(3) STRUCTURE(TEXT(7) BYTE) DATA(
                   ROW4,COL1,'M-1 ',0,
                   ROW4,COL6,'M-2 ',0,
                   ROW4,COL11,'M-3A',0);
196   2         DECLARE NUM$DIGITS(3) BYTE DATA(2,4,4),
                   DATA$ADD(3) ADDRESS DATA(.IFF$M1$CODE,.IFF$M2$CODE,.IFF$M3$CODE);
197   2         DECLARE MIN$CODE(4) BYTE DATA('0000'),
                    MAX$CODE(3) STRUCTURE(DIGITS(4) BYTE) DATA(
                    '7300','7777','7777');
198   2         DECLARE GARD$TEXT$TAB(*) BYTE DATA(ROW2,'M2 GUARDED',0);
199   2         DECLARE (IX,N,ON$OFF$MASK) BYTE;
```

```
                $EJECT
200   2           IX = SW$INDEX;
201   2           IF IX > 0 THEN ON$OFF$MASK = SHL(1,IX);
203   2                     ELSE ON$OFF$MASK = 1;
204   2           N = NUM$DIGITS(IX);
205   2           CALL CLEAR(2);
206   2           CALL GRID(.DIGIT$KB$GRID);
207   2           IF IX = 1 THEN DO;  /* M2 IS GUARDED */
209   3             CALL DISPLAY(.GARD$TEXT$TAB);
210   3             CAL' READ(.GARD$ICB);
211   3             IF SW# = SUBMODE$SW THEN RETURN;
213   3             END;
214   2           CALL CLEAR$LINE(2);
215   2           CALL DISPLAY(.CODE$TAB);
216   2           CALL DISPLAY(.OCTAL$KB$TABLEAU);
217   2           CALL DISPLAY(.LABEL$TAB(IX));
218   2           CALL MOVE(9,.INIT$CODE$ICB,.CODE$ICB);
219   2           CODE$ICB.NUM$CH = N;
220   2           DO FOREVER;
221   3             CALL DISPLAY$SUBMODE$STATUS$LINE;
222   3             CALL READ(.CODE$ICB);
223   3             IF DATA$ENTERED AND (SW# = ENTER$SW) THEN DO;
225   4               IF LIMIT$TEST(.IN$BUF.N,.MIN$CODE,.MAX$CODE(IX)) THEN GO TO A;
227   4               CALL ERROR(0);  /* ILLEGAL ENTRY */
228   4               END;
                    ELSE
229   3             DO CASE SW$INDEX;
230   4               IFF$STATUS = IFF$STATUS AND (NOT ON$OFF$MASK);  /* OFF$SW */
231   4               IFF$STATUS = IFF$STATUS OR ON$OFF$MASK;         /* ON$SW */
232   4               RETURN; /* SUBMODE$SW */
233   4               END;
234   3             END;  /* OF DO FOREVER */
235   2       A:
                  CALL MOVE(N,.IN$BUF,DATA$ADD(IX));
236   2         END;   /* OF CODE$ENTRY */
```

```
                $EJECT
237   1         STAT$PAGE: PROCEDURE;
238   2         DECLARE STAT$TABLEAU(*) BYTE DATA(
                     ROW0,COL7,'IFF STATUS',
                     ROW4,' M1 -',COL12,'M4-',
                     ROW6,' M2 -',COL12,'M-C-',
                     ROW8,' M3A-',COL12,'ANT-',0);
239   2         DECLARE STAT$ENABLE STRUCTURE(
                     SW$MASK(7) BYTE,
                     SW$VALUE(4) BYTE) DATA(
                     0,0,88H,88H,88H,0,80H,
                     03H,14H,25H,60H);
240   2         DECLARE STAT$ICB STRUCTURE(
                     MODE BYTE,
                     NUM$CH BYTE,
                     DELM$CH BYTE,
                     DELM$MASK ADDRESS,
                     ECHO$ROW BYTE,
                     ECHO$COL BYTE,
                     SW$ENABLE ADDRESS) DATA(SWITCH,0,0,0,0,0,.STAT$ENABLE);



241   2         FORMAT$PAGE: PROCEDURE;

                /* FORMAT ROW4 */
242   3            CALL CLEAR$TEMP$BUF;
243   3            CALL MOVE(2,.IFF$M1$CODE,.TEMP$BUF(7));
244   3            IF IFF$STATUS THEN TEMP$BUF(9) = '*';
246   3            IF IFF$M4$MODE THEN TEMP$BUF(15) = 'B';
248   3                           ELSE TEMP$BUF(15) = 'A';
249   3            IF (IFF$STATUS AND 8) > 0 THEN TEMP$BUF(19) = '*';
251   3            CALL UPDATE$LINE(4,0,22,.TEMP$BUF);

                /* FORMAT ROW6 */
252   3            CALL CLEAR$TEMP$BUF;
253   3            CALL MOVE(4,.IFF$M2$CODE,.TEMP$BUF(5));
254   3            IF (IFF$STATUS AND 2) > 0 THEN TEMP$BUF(9) = '*';
256   3            CALL MOVE(3,.OFF$ON$TEXT(INDEX(IFF$STATUS,4,1)),.TEMP$BUF(16));
257   3            IF (IFF$STATUS AND 10H) > 0 THEN TEMP$BUF(19) = '*';
259   3            CALL UPDATE$LINE(6,0,19,.TEMP$BUF);

                /* FORMAT ROW8 */
260   3            CALL MOVE(4,.IFF$M3$CODE,.TEMP$BUF(5));
261   3            IF (IFF$STATUS AND 4) > 0 THEN TEMP$BUF(9) = '*';
263   3            CALL MOVE(3,.ANT$TEXT(IFF$ANTENNA$POSITION),.TEMP$BUF(16));
264   3            CALL UPDATE$LINE(8,0,19,.TEMP$BUF);
265   3         END;   /* OF FORMAT$PAGE */
```

```
                $EJECT
266   2           DO FOREVER;
267   3             CALL CLEAR(0);
268   3             CALL DISPLAY(.STAT$TABLEAU);
269   3             CALL FORMAT$PAGE;
270   3             CALL READ(.STAT$ICB);
271   3             CALL CLEAR$LINE(0);
272   3             DO CASE SW$INDEX;
273   4               CALL CODE$ENTRY;    /* M-1 */
274   4               CALL CODE$ENTRY;    /* M-2 */
275   4               CALL CODE$ENTRY;    /* M-3A */
276   4               CALL M4$SELECT;
277   4               CALL MC$ON$OFF;
278   4               CALL ANT$SELECT;
279   4               RETURN; /* SUBMODE */
280   4              END;
281   3            END;  /* OF DO FOREVER */
282   2       END;   /* OF STAT$PAGE */
```

```
                $EJECT
283   1         IFF$SUBMODE: PROCEDURE PUBLIC;
284   2         DECLARE IFF$SUBMODE$TABLEAU(*) BYTE DATA(
                    ROW0,'IFF',
                    ROW4,' M-1',COL6,'M-2',COL11,'M-3A',COL16,'STAT',
                    ROW6,' M-4',COL6,'NORM',COL11,'STBY',COL16,'ANT',
                    ROW7,COL6,'RAD',
                    ROW8,' M-C',COL6,'TEST',COL11,'TEST',0);
285   2         DECLARE IFF$SW$ENABLE STRUCTURE(
                    SW$MASK(7) BYTE,
                    SW$VALUE(8) BYTE) DATA(
                    0,0,0AEH,0AEH,0A8H,18H,0,
                    01H,23H,34H,55H,66H,78H,9AH,0AOH);
286   2         DECLARE IFF$ICB STRUCTURE(
                    MODE BYTE,
                    NUM$CH BYTE,
                    DELM$CH BYTE,
                    DELM$MASK ADDRESS,
                    ECHO$ROW BYTE,
                    ECHO$COL BYTE,
                    SW$ENABLE ADDRESS) DATA(SWITCH,0,0,0,0,0,.IFF$SW$ENABLE);



287   2           DO FOREVER;
288   3             CALL CLEAR(0);
289   3             CALL GRID(.SUBMODE$GRID);
290   3             CALL DISPLAY(.IFF$SUBMODE$TABLEAU);
291   3             CALL DISPLAY$SUBMODE$STATUS$LINE;
292   3             CALL READ(.IFF$ICB);
293   3             DO CASE SW$INDEX;
294   4               CALL CODE$ENTRY;    /* M-1 */
295   4               CALL CODE$ENTRY;    /* M-2 */
296   4               CALL CODE$ENTRY;    /* M-3A */
297   4               CALL STAT$PAGE;
298   4               CALL M4$SELECT;
299   4               CALL NORM$STBY;
300   4               CALL ANT$SELECT;
301   4               CALL MC$ON$OFF;
302   4               CALL RAD$TEST;
303   4               CALL TEST;
304   4               CALL IFF$ON$OFF;
305   4               END;    /* OF DO CASE */
306   3             END;  /* OF DO FOREVER */

307   2         END;  /* OF IFF$SUBMODE */

308   1         END;  /* OF IFF */


MODULE INFORMATION:

    CODE AREA SIZE     = 0931H   23537
    VARIABLE AREA SIZE = 0013H     19D
    MAXIMUM STACK SIZE = 000EH     14D
    308 LINES READ
```

PL/M-80 COMPILER IFF

0 PROGRAM ERROR(S)

END OF PL/M-80 COMPILATION

```
ISIS-II PL/M-80 V3.1 COMPILATION OF MODULE HWIO
OBJECT MODULE PLACED IN :F1:ABSHWI.OBJ
COMPILER INVOKED BY:  PLM80 :F1:ABSHWI.SRC DATE(27OCT79) DEBUG


            $INTVECTOR(4,20H) TITLE('HWIO')
 1          HWIO: DO;
 2  1       DECLARE RMBUFA(1536) BYTE EXTERNAL,
                 RMBUFB(1536) BYTE EXTERNAL,
                 DEBOUNCE$COUNT BYTE;

 3  1       ADD4SW0: PROCEDURE(SWV) EXTERNAL;
 4  2       DECLARE SWV BYTE;
 5  2       END;


            /* THESE INTERRUPTS (0 AND 1) ARE GENERATED BY THE INTERRUPT CONTROLLER
               (PN 8259) AND REQUIRE INTERRUPT VECTORS AS SPECIFIED BY THE INTVECTOR
               STATEMENT AT THE BEGINNING OF THIS MODULE.
               THESE INTERRUPTS ARE DISTINCT FROM THOSE THAT MAY BE GENERATED BY THE
               PROCESSOR WHICH REQUIRE INTERRUPT VECTORS STARTING AT LOCATION 0. */

 6  1       DEBOUNCE: PROCEDURE INTERRUPT 0;
            /* THIS PROCEDURE STARTS PROGRAMMABLE TIMER 0 WHICH GENERATES THE
               INTERRUPT THAT CAUSES THE MEMBRANE SWITCH TO BE READ. */

 7  2          DEBOUNCE$COUNT = 3; /* DELAY MULTIPLER */
 8  2          OUTPUT(10H) = 0;    /* LSB */
 9  2          OUTPUT(10H) = 0;    /* MSB    40 MS. DELAY */
10  2          OUTPUT(0) = 20H;    /* SIGNAL END OF INTERRUPT */
11  2       END;

12  1       READMEMBRANE$SW: PROCEDURE INTERRUPT 1;
13  2       DECLARE (MASK,ROW,COLS,Q) BYTE,
                 NEW$Q(*) BYTE DATA(0,0,1,0,2,3,0,4),
                 SW$BUF(7) BYTE;

14  2          DEBOUNCE$COUNT = DEBOUNCE$COUNT - 1;
15  2          IF DEBOUNCE$COUNT > 0 THEN DO;
17  3            OUTPUT(10H) = 0;  /* START THE TIMER AGAIN */
18  3            OUTPUT(10H) = 0;
19  3            OUTPUT(0)   = 20H;    /* CLEAR THE INTERRUPT */
20  3            RETURN;
21  3            END;

22  2          MASK = 0FEH;
23  2          DO ROW = 0 TO 6;    /* INPUT DATA FOR ALL ROWS WHILE */
24  3            OUTPUT(30H) = MASK;   /* THE SWITCH IS DEPRESSED. */
25  3            SW$BUF(ROW) = INPUT(31H);
26  3            MASK = ROL(MASK,1);
27  3            END;

28  2          MASK = 1;
29  2          DO ROW = 0 TO 6;
30  3            COLS = NOT SW$BUF(ROW);
31  3            IF COLS > 0 THEN DO;  /* IF THIS IS THE RIGHT ROW THEN ... */
```

```
33  4           Q = - 1;
34  4           DO WHILE COLS > 0;  /* ... LOCATE THE CORRECT COLUMN */
35  5             Q = Q + 1;
36  5             COLS = SHR(COLS,1);
37  5             END;
38  4           IF ROW > 4 THEN Q = NEW$Q(Q); /* CORRECTION FOR LAST TWO ROWS */
40  4           CALL ADD$SWQ(ROW*8 + Q); /*ADD SW VALUE TO INPUT QUEUE*/
41  4           OUTPUT(13H) = 30H;  /* REENABLE THE TIMER */
42  4           OUTPUT(30H) = 0;    /* RESET THE MEMBRANE MASK */
43  4           OUTPUT(0) = 20H;    /* SIGNAL END OF INTERRUPT */
44  4           RETURN;
45  4           END;    /* OF IF COLS > 0 */
46  3         ELSE MASK = SHL(MASK,1);  /* TRY THE NEXT ROW */
47  3         END;  /* OF DO ROW */
48  2       OUTPUT(13H) = 30H;  /* REENABLE TIMER 0 */
49  2       OUTPUT(30H) = 0;    /* RESET THE MEMBRANE MASK */
50  2       OUTPUT(0) = 20H;

51  2     END;   /* OF READ$MEMBRANE$SW */



52  1     SCREEN$INTENSITY: PROCEDURE(LEVEL) PUBLIC;
53  2     DECLARE LEVEL BYTE;

54  2       OUTPUT(32H) = LEVEL;
55  2     END;


56  1     INIT$HARDWARE: PROCEDURE PUBLIC;
          /* INITIALIZE VARIOUS HARDWARE DEVICES */

57  2       DISABLE;
58  2       OUTPUT(33H) = 83H;
59  2       OUTPUT(23H) = 80H;

60  2       OUTPUT(13H) = 30H;  /* RESET TIMER 0 TO MODE 0 */
61  2       OUTPUT(13H) = 70H;  /* RESET TIMER 1 TO MODE 0 */
62  2       OUTPUT(13H) = 0B0H; /* RESET TIMER 2 TO MODE 0 */

63  2       OUTPUT(30H) = 0;    /* LOAD MEMBRANE ENABLE MASK */
64  2       CALL SCREEN$INTENSITY(0);   /* BLANK THE SCREEN */

        /* THE FOLLOWING VALUES MUST AGREE WITH THE VALUES USED IN THE
           INTVECTOR STATEMENT AT THE BEGINNING OF THIS MODULE. */
65  2       OUTPUT(0) = 36H;    /* INITIALIZE INTERRUPT CONTROLLER - ICW1 */
66  2       OUTPUT(1) = 0;  /* INTERVAL = 4, LOCATION - ICW2 */
67  2       OUTPUT(1) = 0FCH;   /* OCW1 */
68  2       ENABLE;

69  2     END;   /* OF INIT$HARDWARE */


70  1     UPDATE$RM: PROCEDURE PUBLIC;
          /* INITIATE DMA TRANSFERS TO LOAD REFRESH MEMORIES */

71  2       DISABLE;
```

```
 72  2          OUTPUT(54H) = LOW(.RMBUFA); /* INITIATE DMA 1 */
 73  2          OUTPUT(54H) = HIGH(.RMBUFA);
 74  2          OUTPUT(55H) = 0FFH; /* LSH OF WORD COUNT */
 75  2          OUTPUT(55H) = 85H;  /* MSH OF WORD COUNT + 80H */
 76  2          OUTPUT(58H) = 4CH;  /* OUTPUT MODE TO DMA CONTROLLER */
 77  2          OUTPUT(22H) = 40H;  /* TOGGLE DMA RQ2 */
 78  2          OUTPUT(22H) = 0;
 79  2          CALL TIME(6CH); /* SHORT DELAY */
 80  2          OUTPUT(56H) = LOW(.RMBUFB);
 81  2          OUTPUT(56H) = HIGH(.RMBUFB);
 82  2          OUTPUT(57H) = 0FFH;
 83  2          OUTPUT(57H) = 85H;
 84  2          OUTPUT(58H) = 4CH;
 85  2          OUTPUT(22H) = 80H;  /* TOGGLE DMA RQ3 */
 86  2          OUTPUT(22H) = 0;
 87  2          ENABLE;

 88  2      END;   /* OF UPDATE$RM */

 89  1      END;   /* OF HWIO */
```

MODULE INFORMATION:

```
    CODE AREA SIZE     = 0186H    390D
    VARIABLE AREA SIZE = 000DH     13D
    MAXIMUM STACK SIZE = 000AH     10D
    128 LINES READ
    0 PROGRAM ERROR(S)

END OF PL/M-80 COMPILATION
```

```
ISIS-II PL/M-80 V3.0 COMPILATION OF MODULE FIL
OBJECT MODULE PLACED IN :F1:FILBUF.OBJ
COMPILER INVOKED BY:  PLM80 :F1:FILBUF.SRC DATE(8MAR79)


          $TITLE('FILBUF')
  1        FIL: DO;
  2  1     DECLARE
            RM$BUFA(1536) BYTE EXTERNAL,    /* 16*6*12 */
            RM$BUFB(1536) BYTE EXTERNAL,
            CH$FONT$DATA(320) BYTE EXTERNAL;
  3  1     DECLARE TRUE   LITERALLY '0FFH',
            FALSE  LITERALLY '0';



  4  1     FILL$BUF: PROCEDURE(ROW,CH$COL,TEXT$PTR,REF$PTR,NCHAR,MODE) PUBLIC;
  5  2     DECLARE ROW BYTE,  /* ROW NUMBER: 0 - 8 */
               CH$COL BYTE,  /* COLUMN ADDRESS OF FIRST CH: 0 - 23 */
               TEXT$PTR ADDRESS, /* TEXT ADDRESS */
               REF$PTR ADDRESS,  /* REFERENCE TEXT ADDRESS */
               NCHAR BYTE,   /* NUMBER OF CHS IN TEXT STRING */
               MODE BYTE:    /* SEE BELOW */

  6  2     DECLARE (TEXT BASED TEXT$PTR)(1) BYTE,
            (REF BASED REF$PTR)(1) BYTE,
            (FONT$PTR,REF$FONT$PTR,BUF$PTR,BUF$OFFSET) ADDRESS,
            (FONT BASED FONT$PTR)(1) BYTE,
            (REF$FONT BASED REF$FONT$PTR)(1) BYTE,
            (BUF BASED BUF$PTR)(1) BYTE,
            (RM$COL,SECTOR,SECTOR$COL,MASK,NOTMASK,N,I,J,K,W,LOC,NEW$MASK,
             REF$LOC,R) BYTE:


          /* THIS PROCEDURE CONVERTS ASCII TEXT STRINGS TO FONT DATA AND UPDATES
             THE REFRESH MEMORY BUFFERS. THE ROW AND COLUMN VALUES DETERMINE THE
             SCREEN COORDINATES OF THE FIRST CHARACTER. EACH NEW CHARACTER IS
             COMPARED WITH THE CHARACTER IN THE CORRESPONDING LOCATION IN THE
             CURRENT DISPLAY BUFFER (HENCE ON THE SCREEN) TO DETERMINE THE ACTION
             NECESSARY TO UPDATE THE REFRESH MEMORY BUFFERS.
             IF MODE = TRUE BLANK INPUT CHARACTERS ARE IGNORED:
             IF MODE = FALSE BLANK INPUT CHARACTERS ARE PROCESSED.
             THE INPUT TEXT STRING MUST BE 24 CHARACTERS OR LESS (ONE LINE). */
```

```
                $EJECT
 7   2      NEW$SECTOR: PROCEDURE;
 8   3        MASK = SHL(MASK,1);
 9   3        NOTMASK = NOT MASK;
10   3        SECTOR = SECTOR + 1;
11   3        IF SECTOR < 6 THEN BUF$PTR = .RM$BUFA + BUF$OFFSET;
13   3                      ELSE BUF$PTR = .RM$BUFB + BUF$OFFSET;
14   3        IF (SECTOR > 5) AND NEW$MASK THEN DO;
16   4          MASK = 1;
17   4          NOTMASK = 0FEH;
18   4          NEW$MASK = FALSE;
19   4          END;
20   3      END;   /* OF NEW$SECTOR */

21   2      UPDATE: PROCEDURE;
22   3        SECTOR$COL = (SECTOR$COL + 1) AND 0FH;  /* MODULO 16 */
23   3        IF SECTOR$COL = 0 THEN CALL NEW$SECTOR;
25   3                          ELSE BUF$PTR = BUF$PTR + 1;
26   3      END;   /* OF UPDATE */

27   2      ADD$NEW$CH: PROCEDURE;
28   3        FONT$PTR = .CH$FONT$DATA + LOC*5;
29   3        REF$FONT$PTR = .CH$FONT$DATA + REF$LOC*5;
30   3        DO J = 0 TO 4;  /* PROCESS 5 CHARACTER FRAGMENTS */
31   4          M = FONT(J);
32   4          R = REF$FONT(J);
33   4          DO K = 0 TO 96 BY 16; /* 7 TIMES */
34   5            IF M THEN BUF(K) = BUF(K) OR MASK;
36   5                 ELSE IF R THEN BUF(K) = BUF(K) AND NOTMASK;
38   5            M = SHR(M,1);
39   5            R = SHR(R,1);
40   5            END;
41   4          CALL UPDATE;
42   4          END;
43   3        CALL UPDATE;    /* SKIP THE SIXTH CHARACTER FRAGMENT */
44   3      END;   /* OF ADD$NEW$CH */

45   2      REMOVE$OLD$CH: PROCEDURE;
46   3        REF$FONT$PTR = .CH$FONT$DATA + REF$LOC*5;
47   3        DO J = 0 TO 4;
48   4          R = REF$FONT(J);
49   4          DO K = 0 TO 96 BY 16;
50   5            IF R THEN BUF(K) = BUF(K) AND NOTMASK;
52   5            R = SHR(R,1);
53   5            END;
54   4          CALL UPDATE;
55   4          END;
56   3        CALL UPDATE;
57   3      END;   /* OF REMOVE$OLD$CH */

58   2      SKIP: PROCEDURE;
59   3        SECTOR$COL = SECTOR$COL + 6;
60   3        IF SECTOR$COL > 15 THEN DO;
62   4          SECTOR$COL = SECTOR$COL - 16;
63   4          CALL NEW$SECTOR;
64   4          BUF$PTR = BUF$PTR + SECTOR$COL;
65   4          END;
```

```
 66  3          ELSE BUF$PTR = BUF$PTR + 6;
 67  3        END;   /* OF SKIP */

            /* BEGIN FILBUF CODE */
 68  2          IF (ROW > 8) OR (CH$COL > 23) THEN RETURN;  /* ERROR */
 70  2          RM$COL = CH$COL*6;
 71  2          SECTOR = RM$COL/16;
 72  2          SECTOR$COL = RM$COL AND 0FH;
 73  2          BUF$OFFSET = 64 + DOUBLE(ROW)*160;
 74  2          IF SECTOR < 6 THEN DO;
 76  3            BUF$PTR = .RM$BUFA + BUF$OFFSET + SECTOR$COL;
 77  3            MASK = 1;
 78  3            IF SECTOR > 0 THEN MASK = SHL(1,SECTOR);
 80  3            NOTMASK = NOT MASK;
 81  3            NEW$MASK = TRUE;
 82  3            END;
 83  2          ELSE DO;        /* SECTOR > 5 */
 84  3            BUF$PTR = .RM$BUFB + BUF$OFFSET + SECTOR$COL;
 85  3            NEW$MASK = FALSE;
 86  3            MASK = ROL(80H,SECTOR - 5);
 87  3            NOTMASK = NOT MASK;
 88  3            END;

 89  2          IF (NCHAR + CH$COL) > 24 THEN N = 23 - CH$COL;
 91  2                                   ELSE N = NCHAR - 1;
 92  2          DO I = 0 TO N;  /* PROCESS EACH CHARACTER */
 93  3            LOC = TEXT(I) - 20H;
 94  3            REF$LOC = REF(I) - 20H;
 95  3            IF LOC = REF$LOC THEN CALL SKIP;/* CH ALREADY IN BUFFER */
 97  3            ELSE DO;
 98  4              IF LOC > 0 THEN CALL ADD$NEW$CH;/* LOC = 0 =>> BLANK */
100  4              ELSE DO;
101  5                IF MODE THEN CALL SKIP;
103  5                       ELSE CALL REMOVE$OLD$CH$;
104  5                END;
105  4            END;
106  3          END;    /* OF DO I */

107  2        END;  /* OF FILL$BUF */

108  1        END;  /* OF CDU */
```

MODULE INFORMATION:

```
    CODE AREA SIZE     = 0326H    806D
    VARIABLE AREA SIZE = 001EH     30D
    MAXIMUM STACK SIZE = 0008H      8D
    136 LINES READ
    0 PROGRAM ERROR(S)
```

END OF PL/M-80 COMPILATION

```
ISIS-II PL/M-80 V3.0 COMPILATION OF MODULE GRID
OBJECT MODULE PLACED IN :F1:GRID.OBJ
COMPILER INVOKED BY:  PLM80 :F1:GRID.SRC DATE(12MAR79) DEBUG


            $TITLE('GRID')
  1         GRID: DO;
  2   1     DECLARE RMSBUFA(1) BYTE EXTERNAL,
              RMSBUFB(1) BYTE EXTERNAL;
  3   1     DECLARE HORZ LITERALLY '0FEH',
              VERT LITERALLY '0FDH';

  4   1     VERT$VECT: PROCEDURE(X,Y0,Y1);
            /* GENERATE REFERESH MEMORY DATA FOR VERTICAL VECTOR.
              THE GENERATED DATA IS 'ORED' WITH THE CONTENTS OF THE REFRESH MEMORY
              BUFFERS RMSBUFA AND RMSBUFB. */
  5   2     DECLARE (X,    /* COLUMN ADDRESS: 0 <= X <= 143 */
                   Y0,   /* STARTING ROW ADDRESS */
                   Y1)   /* ENDING ROW ADDRESS: 0 <= Y0 <= Y1 <= 95 */
                   BYTE;
  6   2     DECLARE (MK,L,N) BYTE,
              (K0,K1,J) ADDRESS;


  7   2       IF (X > 143) OR (Y0 > Y1) OR (Y1 > 95) THEN RETURN;
  9   2       N = SHR(X,4);
 10   2       L = X AND 0FH;
 11   2       K0 = DOUBLE(Y0)*16 + L;
 12   2       K1 = DOUBLE(Y1)*16 + L;
 13   2       IF N < 6 THEN
 14   2         DO;
 15   3           MK = ROL(80H,N + 1);
 16   3           DO J = K0 TO K1 BY 16;
 17   4             RMSBUFA(J) = RMSBUFA(J) OR MK;
 18   4           END;
 19   3         END;
              ELSE
 20   2         DO;
 21   3           MK = ROL(80H,N - 5);
 22   3           DO J = K0 TO K1 BY 16;
 23   4             RMSBUFB(J) = RMSBUFB(J) OR MK;
 24   4           END;
 25   3         END;

 26   2     END;  /* OF VERT$VECT */
```

```
                $EJECT
 27  1          HORZ$VECT: PROCEDURE(X0,X1,Y);
                /* GENERATE REFRESH MEMORY DATA FOR HORIZONTAL VECTORS.
                   THE GENERATED DATA IS 'OFED' WITH THE CONTENTS OF THE REFRESH MEMORY
                   BUFFERS RM$BUFA AND RM$BUFB. */
 28  2          DECLARE (X0,   /* STARTING COLUMN ADDRESS */
                      X1,   /* ENDING COLUMN ADDRESS: 0 <= X0 <= X1 <= 143 */
                      Y)    /* ROW ADDRESS: 0 <= Y <= 95 */
                      BYTE;

 29  2          DECLARE (N0,N1,L0,L1,MK,MK0,MK1,J) BYTE,
                   BUF$PTR ADDRESS,
                   (BUF BASED BUF$PTR)(1) BYTE;



 30  2          PROC$A: PROCEDURE;
                /* GENERATE HORIZONTAL VECTOR RM DATA FOR MEMORY A, SECTORS 0 - 5. */

 31  3             MK0 = 1;
 32  3             IF N0 > 0 THEN MK0 = SHL(1,N0);
 34  3             IF N0 = N1 THEN
 35  3               DO;   /* SHORT VECTOR TOTALLY CONTAINED IN ONE SEGMENT */
 36  4                 DO J = L0 TO L1;
 37  5                   BUF(J) = BUF(J) OR MK0;
 38  5                 END;
 39  4                 RETURN;
 40  4               END;

                /* N1 > N0  -  VECTOR EXTENDS MORE THAN ONE SEGMENT */
 41  3             DO J = L0 TO 15;    /* LEFT-MOST PORTION */
 42  4               BUF(J) = BUF(J) OR MK0;
 43  4             END;

 44  3             IF N1 > 6 THEN MK1 = 40H;
 46  3                       ELSE MK1 = SHL(1,N1);

 47  3             IF (N1 - N0) > 1 THEN
 48  3               DO;   /* MIDDLE PORTION */
 49  4                 MK = MK1 - SHL(MK0,1);
 50  4                 DO J = 0 TO 15;
 51  5                   BUF(J) = BUF(J) OR MK;
 52  5                 END;
 53  4               END;

 54  3             IF N1 < 6 THEN
 55  3               DO J = 0 TO L1;   /* RIGHT-MOST PORTION */
 56  4                 BUF(J) = BUF(J) OR MK1;
 57  4               END;

 58  3          END;   /* OF PROC$A */
```

```
                $EJECT
 59  2      PROC$8: PROCEDURE;
            /* GNERATE HORIZONTAL VECTOR RM DATA FOR MEMORY B, SECTORS 6 - 8. */

 60  3        MK0 = 1;
 61  3        IF N0 > 6 THEN MK0 = SHL(1,N0 - 6);
 63  3        IF N0 > 5 THEN
 64  3          DO;
 65  4            IF N0 = N1 THEN
 66  4              DO;   /* SHORT VECTOR TOTALLY CONTAINED IN ONE SEGMENT */
 67  5                DO J = L0 TO L1;
 68  6                  BUF(J) = BUF(J) OR MK0;
 69  6                END;
 70  5                RETURN;
 71  5              END;
                 /* N1 > N0 */
 72  4            DO J = L0 TO 15;    /* INITIAL PORTION OF VECTOR*/
 73  5              BUF(J) = BUF(J) OR MK0;
 74  5            END;
 75  4          END;

 76  3        MK1 = ROL(80H,N1 - 5);
 77  3        IF (N1 - N0) > 1 THEN
 78  3          DO;
 79  4            MK = MK1 - 1;
 80  4            DO J = 0 TO 15; /* MIDDLE PORTION */
 81  5              BUF(J) = BUF(J) OR MK;
 82  5            END;
 83  4          END;

 84  3        DO J = 0 TO L1; /* END PORTION */
 85  4          BUF(J) = BUF(J) OR MK1;
 86  4        END;

 87  3      END;   /* OF PROC$8 */
```

```
                $EJECT
                /* BEGIN HORZ$VECT PROCESSING */

  88   2          IF (X0 > X1) OR (X1 > 143) OR (Y > 95) THEN RETURN;
  90   2          N0 = SHR(X0,4); /* STARTING SECTOR INDEX: 0 - 8 */
  91   2          N1 = SHR(X1,4); /* ENDING SECTOR INDEX */
  92   2          L0 = X0 AND 0FH;
  93   2          L1 = X1 AND 0FH;
  94   2          IF N0 < 6 THEN
  95   2            DO;
  96   3              BUF$PTR = .RM$BUFA + DOUBLE(Y)*16;
  97   3              CALL PROC$A;
  98   3            END;
  99   2          IF N1 > 5 THEN
 100   2            DO;
 101   3              BUF$PTR = .RM$BUFB + DOUBLE(Y)*16;
 102   3              CALL PROC$B;
 103   3            END;

 104   2        END;  /* OF HORZ$VECT */
```

```
                $EJECT
105   1         GRID: PROCEDURE(LIST$PTR) PUBLIC;
                /* GENERATE RM DATA FOR A GRID DEFINED BY A LIST OF HORIZONTAL
                   AND VERTICAL VECTORS. THE LIST HAS THE FOLLOWING FORMAT:
                   GRID$LIST := ((DIR, START, END, LOC1, LOC2, ..., LOCN), OFFH)

                   1. IF DIR = HORZ THEN START = X0; END = X1; LOCI = YI, 1 <= I <= N.
                      THIS DEFINES N HORIZONTAL VECTORS AT COORDINATE POSITION
                      (X0,Y1-X1,Y1), (X0,Y2-X1,Y2), ..., (X0,YN-X1,YN).

                   2. IF DIR = VERT THEN START = Y0; END = YI, LOCI = XI, 1 <= I <= N.
                      THIS DEFINES N VERTICAL VECTORS AT COORDINATE POSITIONS
                      (X1,Y0-X1,Y1), (X2,Y0-X2,Y1), ..., (XN,Y0-XN,Y1).

                   THE INNER SUBLIST MAY BE REPEATED AS MANY TIMES AS NECESSARY.
                   THE LIST TERMINATOR (OFFH) IS REQUIRED. */

106   2           DECLARE LIST$PTR ADDRESS,
                      (LIST BASED LIST$PTR)(1) BYTE,
                     (CH,I,X0,X1,Y0,Y1) BYTE;

107   2           CH = LIST(0);
108   2           I = 0;
109   2           DO WHILE CH<> OFFH;
110   3             IF CH = HORZ THEN
111   3               DO;
112   4                 X0 = LIST(I + 1);
113   4                 X1 = LIST(I + 2);
114   4                 CH = LIST(I + 3);
115   4                 I = I + 3;
116   4                 DO WHILE CH < OFOH;
117   5                   CALL HORI$VECT(X0,X1,CH);
118   5                   I = I + 1;
119   5                   CH = LIST(I);
120   5                 END;
121   4               END;
                      ELSE
122   3               DO;
123   4                 IF CH = VERT THEN
124   4                   DO;
125   5                     Y0 = LIST(I + 1);
126   5                     Y1 = LIST(I + 2);
127   5                     CH = LIST(I + 3);
128   5                     I = I + 3;
129   5                     DO WHILE CH < OFOH;
130   6                       CALL VERT$VECT(CH, X0,Y1);
131   6                       I = I + 1;
132   6                       CH = LIST(I);
133   6                     END;
134   5                   END;
135   4                 ELSE RETURN;    /* ERROR */
136   4               END;
137   3             END;    /* OF DO WHILE CH <> OFFH */

138   2           END;  /* OF GEN$GRID */

139   1           END;  /* OF COUGRD: DO; */
```

PL/M-80 COMPILER GRID

MODULE INFORMATION:

```
    CODE AREA SIZE     = 0453H  1107D
    VARIABLE AREA SIZE = 0021H    33D
    MAXIMUM STACK SIZE = 0006H     6D
    203 LINES READ
    0 PROGRAM ERROR(S)
```

END OF PL/M-80 COMPILATION

```
ISIS-II PL/M-80 V3.1 COMPILATION OF MODULE DNV
OBJECT MODULE PLACED IN :F1:DNV.OBJ
COMPILER INVOKED BY: PLM80 :F1:DNV.SRC DATE(27OCT79) DEBUG


                $TITLE('DNV')
                /* INIT$DNV, DISPLAY$ACTIVE$WAYPT, DISPLAY$PRESENT$POSITION, DNV$SUBMODE, DNV$NAV$STATUS */
  1             DNV: DO;
  2   1         DECLARE HORZ LITERALLY '0FEH',
                    VERT LITERALLY '0FDH';
                $NOLIST INCLUDE(:F1:CDULIT.SRC)
  5   1         DNV$FLY$TO: PROCEDURE EXTERNAL;
  6   2         END;
  7   1         DNV$BACKUP$NAV: PROCEDURE EXTERNAL;
  8   2         END;
  9   1         DNV$WAYPT$STATUS: PROCEDURE(TYPE) EXTERNAL;
 10   2         DECLARE TYPE BYTE;
 11   2         END;
 12   1         DNV$CKPT: PROCEDURE EXTERNAL;
 13   2         END;
 14   1         FORMAT$WAYPT$COORD: PROCEDURE(WAYPT$ADD) EXTERNAL;
 15   2         DECLARE WAYPT$ADD ADDRESS;
 16   2         END;
 17   1         PACK$WAYPT: PROCEDURE(NBYTES,SOURCE$PTR,DEST$PTR) EXTERNAL;
 18   2         DECLARE NBYTES BYTE, (SOURCE$PTR,DEST$PTR) ADDRESS;
 19   2         END;
 20   1         UNPACK$WAYPT: PROCEDURE(NBYTES,SOURCE$PTR,DEST$PTR) EXTERNAL;
 21   2         DECLARE NBYTES BYTE, (SOURCE$PTR,DEST$PTR) ADDRESS;
 22   2         END;
 23   1         DNV$TGT: PROCEDURE EXTERNAL;
 24   2         END;
 25   1         DNV$UPDATE: PROCEDURE EXTERNAL;
 26   2         END;
 27   1         CLEAR: PROCEDURE(START$ROW) EXTERNAL;
 28   2         DECLARE START$ROW BYTE;
 29   2         END;
 30   1         CLEAR$TEMP$BUF: PROCEDURE EXTERNAL;
 31   2         END;
 32   1         INSERT: PROCEDURE(NCHAR,SOURCE$PTR,DEST$PTR,DELM$CH,DELM$MASK) EXTERNAL;
 33   2         DECLARE (NCHAR,DELM$CH) BYTE, (SOURCE$PTR,DEST$PTR,DELM$MASK) ADDRESS;
 34   2         END;
 35   1         GRID: PROCEDURE(POINTER) EXTERNAL;
 36   2         DECLARE POINTER ADDRESS;
 37   2         END;
 38   1         DISPLAY: PROCEDURE(IN$PTR) EXTERNAL;
 39   2         DECLARE IN$PTR ADDRESS;
 40   2         END;
 41   1         READ: PROCEDURE(ICB$PTR) EXTERNAL;
 42   2         DECLARE ICB$PTR ADDRESS;
 43   2         END;
 44   1         UPDATE$LINE: PROCEDURE(ROW,COL,NCHAR,TEXT$PTR) EXTERNAL;
 45   2         DECLARE (ROW,COL,NCHAR) BYTE, TEXT$PTR ADDRESS;
 46   2         END;

                /* PUBLIC VARIABLES USED BY DNV PROCEDURES */
 47   1         DECLARE ZERO(*) BYTE PUBLIC DATA('000');
```

```
 48  1      DECLARE SUBMODE$STEP$SW$ENABLE STRUCTURE(
              SW$MASK(7) BYTE,
              SW$VALUE(1) BYTE) PUBLIC DATA(0,0,0,0,0,0,88H);
 49  1      DECLARE SUBMODE$SW$ENABLE STRUCTURE(
              SW$MASK(7) BYTE,
              SW$VALUE(1) BYTE) PUBLIC DATA(0,0,0,0,0,0,80H,0);

 50  1      DECLARE SUBMODE$ICB STRUCTURE(
              MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
              ECHO$ROW BYTE, ECHO$COL BYTE, SW$ENABLE ADDRESS) DATA(
              SWITCH,0,0,0,0,0,.SUBMODE$SW$ENABLE);
 51  1      DECLARE SINGLE$DIGIT$ICB  STRUCTURE(
              MODE BYTE,
              NUM$CH BYTE,
              DELM$CH BYTE,
              DELM$MASK ADDRESS,
              ECHO$ROW BYTE,
              ECHO$COL BYTE,
              SW$ENABLE ADDRESS) PUBLIC DATA(DIGIT,1,0,0,2,5,.SUBMODE$SW$ENABLE);
 52  1      DECLARE SUB$SUBMODE$GRID(*) BYTE PUBLIC DATA(
              HORZ,0,92,22,32,
              HORZ,2,92,52,72,92,
              VERT,32,92,2,32,62,
              VERT,22,92,92,0FFH);

            /* EXTERNAL VARIABLES */
 53  1      DECLARE
              OFF$ON$TEXT(2) STRUCTURE(CH(3) BYTE) EXTERNAL,
              BLANK$LINE(24) BYTE EXTERNAL,
              TEMP$BUF(24) BYTE EXTERNAL,
              SW BYTE EXTERNAL,
              SW$INDEX BYTE EXTERNAL,
              SUBMODE$GRID ADDRESS EXTERNAL,
              DNV$GROUND$SPEED BYTE EXTERNAL,
              DNV$RANGE BYTE EXTERNAL,
              DNV$TRACK$ANGLE$ERROR BYTE EXTERNAL,
              DNV$BEARING BYTE EXTERNAL,
              DNV$TRACK$ANGLE BYTE EXTERNAL,
              DNV$CROSS$TRACK$ANGLE BYTE EXTERNAL,
              DNV$TIME$TO$GO BYTE EXTERNAL,
              DNV$WIND$SPEED(1) BYTE EXTERNAL,
              DNV$WIND$DIR BYTE EXTERNAL,
              DNV$DESTINATION BYTE EXTERNAL,
              DNV$STATUS BYTE EXTERNAL,
              DNV$TEMP$WAYPT STRUCTURE(
                STATUS BYTE,
                UTM$SPHEROID BYTE,
                UTM$ZONE(2) BYTE,
                UTM(11) BYTE,
                LAT(6) BYTE,
                LON(7) BYTE,
                MAGVAR(6) BYTE) EXTERNAL,
              DNV$LAST$WAYPT$PTR ADDRESS EXTERNAL,
              DNV$CKPT$DATA(10) STRUCTURE(DIGITS(68) BYTE) EXTERNAL,
              DNV$TGT$DATA(10) STRUCTURE(DIGITS(68) BYTE) EXTERNAL;
```

```
                $EJECT
 54  1      INIT$DNV: PROCEDURE PUBLIC;
 55  2      DECLARE I BYTE,
                ZERO BYTE DATA(0);

 56  2        DNV$LAST$WAYPT$PTR = .DNV$CKPT$DATA;    /* PRESENT POSITION */
 57  2        DNV$STATUS = 0;
 58  2        DNV$DESTINATION = 0;
                /* CLEAR ALL TARGETS AND CHECKPOINTS; IE. SET WAYPT.STATUS = 0 */
 59  2        DO I = 0 TO 9;
 60  3          CALL PACK$WAYPT(1,.ZERO,.DNV$CKPT$DATA(I));
 61  3          CALL PACK$WAYPT(1,.ZERO,.DNV$TGT$DATA(I));
 62  3          END;
 63  2        DNV$WIND$SPEED(0) = ' ';
 64  2        CALL MOVE(26,.DNV$WIND$SPEED,.DNV$WIND$SPEED(1));
                /* INITIALIZE VARIABLES APPEARING ON NAV STATUS TABLEAU */
 65  2        CALL MOVE(4,.('1635'),.DNV$RANGE);
 66  2        CALL MOVE(3,.('104'),.DNV$TRACK$ANGLE$ERROR);
 67  2        CALL MOVE(3,.('273'),.DNV$BEARING);
 68  2        CALL MOVE(3,.('205'),.DNV$CROSS$TRACK$ANGLE);
 69  2        CALL MOVE(3,.('200'),.DNV$TIME$TO$GO);
                /* INITIALIZE PRESENT POSITION */
 70  2        DNV$TEMP$WAYPT.STATUS = 6;  /* L/L AND UTM DATA AVAILABLE */
 71  2        CALL MOVE(13,.('N34112W118354'),.DNV$TEMP$WAYPT.LAT);
 72  2        DNV$TEMP$WAYPT.UTM$SPHEROID = 1;
 73  2        CALL MOVE(13, .('01ABC12345678'), .DNV$TEMP$WAYPT.UTM$ZONE);
 74  2        CALL PACK$WAYPT(34,.DNV$TEMP$WAYPT,.DNV$CKPT$DATA); /* STORE INTO CKPT(0) */
 75  2      END;   /* OF INIT$DNV */



 76  1      DISPLAY$ACTIVE$WAYPT: PROCEDURE PUBLIC;
 77  2      DECLARE WAYPT$DESCRIPTOR(2) STRUCTURE(TEXT(4) BYTE) DATA('CKPT TGT');
 78  2      DECLARE I BYTE;

 79  2        CALL CLEAR$TEMP$BUF;
 80  2        CALL MOVE(4,.WAYPT$DESCRIPTOR(DNV$DESTINATION AND 1),.TEMP$BUF);
 81  2        TEMP$BUF(5) = (SHR(DNV$DESTINATION,1) AND 0FH) + 30H;
 82  2        CALL UPDATE$LINE(0,18,6,.TEMP$BUF);
 83  2      END;   /* OF DISPLAY$ACTIVE$WAYPT */



 84  1      DISPLAY$PRESENT$POSITION: PROCEDURE(ROW) PUBLIC;
 85  2      DECLARE ROW BYTE;

 86  2        CALL CLEAR$TEMP$BUF;
 87  2        CALL UNPACK$WAYPT(34,.DNV$CKPT$DATA(0),.DNV$TEMP$WAYPT);
 88  2        CALL FORMAT$WAYPT$COORD(.DNV$TEMP$WAYPT);
 89  2        TEMP$BUF(0),TEMP$BUF(1) = 'P';
 90  2        CALL UPDATE$LINE(ROW,0,24,.TEMP$BUF);
 91  2      END;
```

```
                $EJECT
 92  1      DNV$SUBMODE: PROCEDURE PUBLIC;

 93  2      DECLARE DNV$SUBMODE$TABLEAU(*) BYTE DATA(
                ROW0,'DNV',
                ROW3,' FLY',COL6,'CXPT BKUP NAV',
                ROW4,' TO',COL12,'NAV STAT',
                ROW5,' NEXT',COL16,'CXPT',
                ROW6,' CXPT',COL6,'UTM',COL12,'L/L STAT',
                ROW7,' TGT',COL7,'UP',COL11,'TEST TGT',
                ROW8,COL6,'DATE',COL16,'STAT',0);
 94  2      DECLARE DNV$SW$ENABLE STRUCTURE(
                SW$MASK(7) BYTE,
                SW$VALUE(9) BYTE) DATA(
                0,0,0AEH,0EEH,0AEH,18H,0,
                01H,23H,34H,45H,67H,78H,9AH,0BBH,0CDH);
 95  2      DECLARE DNV$ICB STRUCTURE(
                MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
                ECHO$ROW BYTE, ECHO$COL BYTE, SW$ENABLE ADDRESS) DATA(
                SWITCH,0,0,0,0,0,.DNV$SW$ENABLE);



 96  2      DNV$NAV$STATUS: PROCEDURE;
 97  3      DECLARE STATUS$TABLEAU(*) BYTE DATA(
                ROW0,'DNV',COL9,'STATUS',
                ROW4,'RGE',COL9,'GSPD',COL17,'TKE',
                ROW6,'BRG',COL9,'TRK',COL17,'XTKE',
                ROW8,'TTG',COL9,'WIND',COL16,'/',0);
 98  3      DECLARE DATA$ADD(9) ADDRESS  DATA(
                .DNV$RANGE,
                .DNV$GROUND$SPEED,
                .DNV$TRACK$ANGLE$ERROR,
                .DNV$BEARING,
                .DNV$TRACK$ANGLE,
                .DNV$CROSS$TRACK$ANGLE,
                .DNV$TIME$TO$GO,
                .DNV$WIND$SPEED,
                .DNV$WIND$DIR);
 99  3      DECLARE NCHAR(9) BYTE DATA(4,3,3,3,3,3,3,2,3);
        /* THE FOLLOWING ARE THE LEFT BYTES OF THE INSERT MASK */
100  3      DECLARE MSB$INSERT$MASK(9) BYTE DATA(10H,0,0,0,0,20H,0,0,0);
101  3      DECLARE MASK ADDRESS,
                MASK$OVERLAY(2) BYTE AT(.MASK);
102  3      DECLARE DEST$LOC(9) ADDRESS DATA(
                .TEMP$BUF+3,.TEMP$BUF+13,.TEMP$BUF+20,
                .TEMP$BUF+3,.TEMP$BUF+12,.TEMP$BUF+20,
                .TEMP$BUF+3,.TEMP$BUF+17,.TEMP$BUF+13);
103  3      DECLARE (I,J,IX) BYTE;



104  3         CALL CLEAR(2);
105  3         CALL DISPLAY(.STATUS$TABLEAU);
106  3         CALL DISPLAY$PRESENT$POSITION(2);
107  3         MASK$OVERLAY(0) = 0;
108  3         DO I = 0 TO 2;
```

```
109  4          CALL CLEAR$TEMP$BUF;
110  4          DO J = 0 TO 2;
111  5            IX = I*3 + J;
112  5            MASK$OVERLAY(I) = MSB$INSERT$MASK(IX);
113  5            CALL INSERT(NCHAR(IX),DATA$ADD(IX),DEST$LOC(IX),
                           ',',MSB$INSERT$MASK(IX));
114  5            END;
115  4          CALL UPDATE$LINE(I*2+4,0,24,.TEMP$BUF);
116  4          END;
117  3        CALL READ(.SUBMODE$ICB);    /* WAIT FOR SUBMODE SW ENTRY */

118  3      END;   /* OF DNV$WAV$STAT */
```

```
            $EJECT
             /* BEGIN DNV SUBMODE */
 119   2        DO FOREVER;
 120   3          CALL CLEAR(0);
 121   3          CALL UPDATE$LINE(1,0,3,.OFF$ON$TEXT(SHR(DNV$STATUS,4)));
 122   3          CALL GRID(.SUBMODE$GRID);
 123   3          CALL DISPLAY(.DNV$SUBMODE$TABLEAU);
 124   3          CALL DISPLAY$ACTIVE$WAYPT;
 125   3          CALL DISPLAY$PRESENT$POSITION(2);
 126   3          CALL READ(.DNV$ICB);
 127   3          DO CASE SW$INDEX;
 128   4            CALL DNV$FLY$TO;
 129   4            CALL DNV$CKPT;
 130   4            CALL DNV$BACKUP$NAV;
 131   4            CALL DNV$NAV$STATUS;
 132   4            DNV$DESTINATION = (DNV$DESTINATION AND 1) OR
                                  SHL((SHR(DNV$DESTINATION,1) + 1) MOD 10,1);
 133   4            DNV$STATUS = DNV$STATUS OR 1;   /* UTM */
 134   4            DNV$STATUS = DNV$STATUS AND 0FEH;   /* L/L */
 135   4            CALL DNV$WAYPT$STATUS(CKPT);    /* CKPT STATUS */
 136   4            CALL DNV$TGT;
 137   4            CALL DNV$UPDATE;
 138   4            ;                               /* DNV TEST */
 139   4            CALL DNV$WAYPT$STATUS(TGT);     /* TGT STATUS */
 140   4            DNV$STATUS = DNV$STATUS AND 0EFH;   /* OFF */
 141   4            DNV$STATUS = DNV$STATUS OR 10H; /* ON  */
 142   4            END;    /* OF DO CASE */
 143   3          END;  /* OF DO FOREVER */
 144   2      END;   /* OF DNV$SUBMODE */

 145   1      END;   /* OF DNV */


MODULE INFORMATION:

    CODE AREA SIZE     = 0464H   1124D
    VARIABLE AREA SIZE = 0009H      9D
    MAXIMUM STACK SIZE = 000AH     10D
    315 LINES READ
    0 PROGRAM ERROR(S)

END OF PL/M-80 COMPILATION
```

```
ISIS-II PL/M-80 V3.0 COMPILATION OF MODULE DNV1
OBJECT MODULE PLACED IN :F1:DNV1.OBJ
COMPILER INVOKED BY:  PLM80 :F1:DNV1.SRC DATE(9MAR79) DEBUG


                $TITLE('DNV1')
                 /* DNV$CKPT, DNV$TGT, DNV$FLY$TO */
     1          DNV1: DO;
                $NOLIST INCLUDE(:F1:CDULIT.SRC)
     4    1     DNV$COORD$DATA$ENTRY: PROCEDURE(WAYPT$PTR,WAYPT$TYPE) BYTE EXTERNAL;
     5    2     DECLARE WAYPT$PTR ADDRESS, WAYPT$TYPE BYTE;
     6    2     END;
     7    1     CLEAR: PROCEDURE(START$ROW) EXTERNAL;
     8    2     DECLARE START$ROW BYTE;
     9    2     END;
    10    1     GRID: PROCEDURE(POINTER) EXTERNAL;
    11    2     DECLARE POINTER ADDRESS;
    12    2     END;
    13    1     DISPLAY: PROCEDURE(IN$PTR) EXTERNAL;
    14    2     DECLARE IN$PTR ADDRESS;
    15    2     END;
    16    1     DISPLAY$DIGIT$KB: PROCEDURE EXTERNAL;
    17    2     END;
    18    1     READ: PROCEDURE(ICB$PTR) EXTERNAL;
    19    2     DECLARE ICB$PTR ADDRESS;
    20    2     END;
    21    1     UPDATE$LINE: PROCEDURE(ROW,COL,NCHAR,TEXT$PTR) EXTERNAL;
    22    2     DECLARE (ROW,COL,NCHAR) BYTE, TEXT$PTR ADDRESS;
    23    2     END;
    24    1     ERROR: PROCEDURE(CODE) EXTERNAL;
    25    2     DECLARE CODE BYTE;
    26    2     END;
    27    1     PACK$WAYPT: PROCEDURE(NBYTES,SOURCE$PTR,DEST$PTR) EXTERNAL;
    28    2     DECLARE NBYTES BYTE, (SOURCE$PTR,DEST$PTR) ADDRESS;
    29    2     END;
    30    1     UNPACK$WAYPT: PROCEDURE(NBYTES,SOURCE$PTR,DEST$PTR) EXTERNAL;
    31    2     DECLARE NBYTES BYTE,(SOURCE$PTR,DEST$PTR) ADDRESS;
    32    2     END;

                /* EXTERNAL VARIABLES */
    33    1     DECLARE
                    BLANK$LINE(24) BYTE EXTERNAL,
                    SW BYTE EXTERNAL,
                    SW$INDEX BYTE EXTERNAL,
                    DATA$ENTERED BYTE EXTERNAL,
                    IN$BUF(1) BYTE EXTERNAL,
                    SINGLE$DIGIT$ICB ADDRESS EXTERNAL,
                    SUBMODE$GRID BYTE EXTERNAL,
                    SUB$SUBMODE$GRID BYTE EXTERNAL,
                    SUBMODE$SW$ENABLE BYTE EXTERNAL,

                    DNV$TEMP$WAYPT STRUCTURE(
                      STATUS BYTE,
                      UTM(14) BYTE,
                      LAT(6) BYTE,
                      LON(7) BYTE,
```

```
        MAGVAR(6) BYTE) EXTERNAL,

      DNV$DESTINATION BYTE EXTERNAL,
      DNV$LAST$WAYPT$PTR ADDRESS EXTERNAL,
      DNV$CKPT$DATA(10) STRUCTURE(DIGITS(68) BYTE) EXTERNAL,
      DNV$TGT$DATA(10) STRUCTURE(DIGITS(68) BYTE) EXTERNAL;




34  1   DNV$CKPT: PROCEDURE PUBLIC;
35  2   DECLARE CKPT$TABLEAU(*) BYTE DATA(
          ROW2,'CKPT',
          ROW3,COL6,'CKPT',0);
36  2   DECLARE CKPT$NUM BYTE;


37  2     CALL CLEAR(2);
38  2     CALL DISPLAY$DIGIT$KB;
39  2     CALL DISPLAY(.CKPT$TABLEAU);
40  2     CALL READ(.SINGLE$DIGIT$ICB);
41  2     IF SW = SUBMODE$SW THEN RETURN;
43  2     IF DATA$ENTERED THEN DO;
45  3       CKPT$NUM = IN$BUF(0) - 30H;
46  3       IF DNV$COORD$DATA$ENTRY(.DNV$TEMP$WAYPT,CKPT) = 0 THEN RETURN;    /* SUBMODE RETURN */
48  3       CALL PACK$WAYPT(34,.DNV$TEMP$WAYPT,.DNV$CKPT$DATA(CKPT$NUM));
49  3       DNV$LAST$WAYPT$PTR = .DNV$CKPT$DATA(CKPT$NUM);
50  3       END;
51  2   END;  /* OF DNV$CKPT */
```

```
                $EJECT
 52  1      DNV$TGT: PROCEDURE PUBLIC;
 53  2      DECLARE TGT$TABLEAU(*) BYTE DATA(
                ROW2,' TGT',
                ROW4,' FRZE',
                ROW7,' TGT',0);
 54  2      DECLARE FRZE$SUBMODE$SW$ENABLE STRUCTURE(
                SW$MASK(7) BYTE,
                SW$VALUE(1) BYTE) DATA(
                0,0,80H,0,0,0,80H,
                01H);
 55  2      DECLARE TGT$ICB STRUCTURE(
                MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
                ECHO$ROW BYTE, ROW$COL BYTE, SW$ENABLE ADDRESS) DATA(
                DIGIT,1,0,0,2,5,.FRZE$SUBMODE$SW$ENABLE);
 56  2      DECLARE FRZE$TAB(*) BYTE DATA(ROW2,'FRZE',0);
 57  2      DECLARE TGT$ICB2 STRUCTURE(
                MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
                ECHO$ROW BYTE, ECHO$COL BYTE, SW$ENABLE ADDRESS) DATA(
                DIGIT,1,0,0,2,5,.SUBMODE$SW$ENABLE);
 58  2      DECLARE TGT$NUM BYTE,
                I BYTE;
 59  2      DECLARE FRZE$SW LITERALLY '200';


 60  2      A:
                CALL CLEAR(2);
 61  2             CALL DISPLAY$DIGIT$KB;
 62  2             CALL DISPLAY(.TGT$TABLEAU);
 63  2             CALL READ(.TGT$ICB);
 64  2             IF SWV = SUBMODE$SW THEN RETURN;
 66  2             IF SWV = FRZE$SW THEN GO TO B;
 68  2             IF DATA$ENTERED THEN DO;
 70  3               TGT$NUM = IN$BUF(0) - 30H;
 71  3               IF DNV$COORD$DATA$ENTRY(.DNV$TEMP$WAYPT,TGT) = 0 THEN RETURN; /* SUBMODE RETURN */
 73  3               CALL PACK$WAYPT(34,.DNV$TEMP$WAYPT,.DNV$TGT$DATA(TGT$NUM));
 74  3               DNV$LAST$WAYPT$PTR = .DNV$TGT$DATA(TGT$NUM);
 75  3               RETURN;
 76  3               END;
 77  2             ELSE DO;
 78  3               CALL ERROR(0);
 79  3               GO TO A;
 80  3               END;
 81  2      B:
                /* FRZE SWITCH PRESSED, RECORD PRESENT POSITION. */
                CALL DISPLAY(.FRZE$TAB);
 82  2             CALL READ(.TGT$ICB2);
 83  2             IF SWV = SUBMODE$SW THEN RETURN;
 85  2             IF SWV = ENTER$SW THEN DO;
 87  3               IF DATA$ENTERED THEN TGT$NUM = IN$BUF(0) - 30H;
 89  3               ELSE DO;
 90  4                 DO TGT$NUM = 6 TO 9;
 91  5                   CALL UNPACK$WAYPT(1,.DNV$TGT$DATA(TGT$NUM),.DNV$TEMP$WAYPT);
 92  5                   IF (DNV$TEMP$WAYPT.STATUS AND 6) = 0 THEN GO TO C;
 94  5                   END;
 95  4                 CALL ERROR(1);  /* NO UNALLOCATED TARGETS */
 96  4                 GO TO A;
```

```
 97  4            END;   /* OF ELSE DO */
 98  3       C:
             /* COPY PRESENT POSITION TO DESIGNATED TARGET */
                CALL UNPACK$WAYPT(34,.DNV$WAYPT$DATA(0),.DNV$TEMP$WAYPT);
     3          CALL PACK$WAYPT(34,.DNV$TEMP$WAYPT,.DNV$TGT$DATA(TGT$NUM));
     3          END;
             /* DISPLAY COORDINATES OF TARGET AND TARGET NUMBER */


101  2       END;   /* OF DNV$TGT */
```

```
                $EJECT
102   1       DNV$FLY$TO: PROCEDURE PUBLIC;
103   2       DECLARE FLY$TO$TABLEAU(*) BYTE DATA(
                  ROW3,' FLY',
                  ROW4,' TO',0);
104   2       DECLARE TYPE(2) STRUCTURE(CH(7) BYTE) DATA(
                  ROW3,COL6,'CKPT',0,
                  ROW7,COL1,' TGT',0);
105   2       DECLARE TOT(*) BYTE DATA(ROW2,' TO',0);
106   2       DECLARE FLY$TO$ENABLE STRUCTURE(
                  SW$MASK(7) BYTE,
                  SW$VALUE(2) BYTE) DATA(
                  0,0,20H,0,80H,0,80H,    /*CKPT,TGT,SUBMODE */
                  01H,20H);
107   2       DECLARE FLY$TO$ICB STRUCTURE(
                  MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
                  ECHO$ROW BYTE, ECHO$COL BYTE, SW$ENABLE ADDRESS) DATA(
                  SWITCH,0,0,0,0,0,.FLY$TO$ENABLE);


108   2         CALL CLEAR(2);
109   2         CALL DISPLAY(.FLY$TO$TABLEAU);
110   2         CALL DISPLAY(.TYPE(0));
111   2         CALL DISPLAY(.TYPE(1));
112   2         CALL GRID(.SUB$SUBMODE$GRID);
113   2         CALL READ(.FLY$TO$ICB);
114   2         IF SWV = SUBMODE$SW THEN RETURN;
116   2         DNV$DESTINATION = SW$INDEX;
117   2         CALL CLEAR(2);
118   2         CALL DISPLAY(.TOT);
119   2         CALL DISPLAY(.FLY$TO$TABLEAU);
120   2         CALL DISPLAY(.TYPE(SW$INDEX));
121   2         CALL DISPLAY$DIGIT$KB;
122   2         CALL READ(.SINGLE$DIGIT$ICB);
123   2         IF DATA$ENTERED AND (SWV = ENTER$SW) THEN
124   2           DNV$DESTINATION = DNV$DESTINATION OR SHL(IN$BUF(0)-30H,1);
125   2       END;   /* OF DNV$FLY$TO */

126   1       END;   /* OF DNV1 */
```

MODULE INFORMATION:

```
    CODE AREA SIZE     = 0263H    611D
    VARIABLE AREA SIZE = 0003H      3D
    MAXIMUM STACK SIZE = 0004H      4D
    245 LINES READ
    0 PROGRAM ERROR(S)

END OF PL/M-80 COMPILATION
```

```
ISIS-II PL/M-80 V3.0 COMPILATION OF MODULE DNV2
OBJECT MODULE PLACED IN :F1:DNV2.OBJ
COMPILER INVOKED BY:  PLM80 :F1:DNV2.SRC DATE(12MAR79) DEBUG


                $TITLE('DNV2')
                 /* DISPLAY$WAYPT$TYPE, LAT$LON$DATA$ENTRY, MAGVAR$DATA$ENTRY, DNV$COORD$DATA$ENTRY */
  1             DNV2: DO;
                $NOLIST INCLUDE(:F1:COULIT.SRC)
  4  1          CLEAR: PROCEDURE(START$ROW) EXTERNAL;
  5  2          DECLARE START$ROW BYTE;
  6  2          END;
  7  1          ERROR : PROCEDURE(CODE) EXTERNAL;
  8  2          DECLARE CODE BYTE;
  9  2          END;
 10  1          GRID: PROCEDURE(POINTER) EXTERNAL;
 11  2          DECLARE POINTER ADDRESS;
 12  2          END;
 13  1          DISPLAY: PROCEDURE(IN$PTR) EXTERNAL;
 14  2          DECLARE IN$PTR ADDRESS;
 15  2          END;
 16  1          READ: PROCEDURE(ICB$PTR) EXTERNAL;
 17  2          DECLARE ICB$PTR ADDRESS;
 18  2          END;
 19  1          UPDATE$LINE: PROCEDURE(ROW,COL,NCHAR,TEXT$PTR) EXTERNAL;
 20  2          DECLARE (ROW,COL,NCHAR) BYTE, TEXT$PTR ADDRESS;
 21  2          END;
 22  1          LIMIT$TEST: PROCEDURE(BUF$PTR,NCHAR,MIN$PTR,MAX$PTR) BYTE EXTERNAL;
 23  2          DECLARE NCHAR BYTE, (BUF$PTR,MIN$PTR,MAX$PTR) ADDRESS;
 24  2          END;
 25  1          INSERT: PROCEDURE(NCHAR,SOURCE$PTR,DEST$PTR,DELM$CH,DELM$MASK) EXTERNAL;
 26  2          DECLARE (NCHAR,DELM$CH) BYTE, (SOURCE$PTR,DEST$PTR,DELM$MASK) ADDRESS;
 27  2          END;
 28  1          UNPACK$WAYPT: PROCEDURE(NBYTES,SOURCE$PTR,DEST$PTR) EXTERNAL;
 29  2          DECLARE NBYTES BYTE,(SOURCE$PTR,DEST$PTR) ADDRESS;
 30  2          END;
 31  1          DNV$UTM$DATA$ENTRY: PROCEDURE(WAYPT$ADD,WAYPT$TYPE) BYTE EXTERNAL;
 32  2          DECLARE WAYPT$ADD ADDRESS, WAYPT$TYPE BYTE;
 33  2          END;

                /* EXTERNAL VARIABLES */
 34  1          DECLARE
                   OFF$ON$TEXT(6) BYTE EXTERNAL,
                   BLANK$LINE(24) BYTE EXTERNAL,
                   SW BYTE EXTERNAL,
                   SW$INDEX BYTE EXTERNAL,
                   DATA$ENTERED BYTE EXTERNAL,
                   IN$BUF(1) BYTE EXTERNAL,
                   ZERO(1) BYTE EXTERNAL,
                   SUBMODE$GRID ADDRESS EXTERNAL,
                   SUBMODE$SW$ENABLE ADDRESS EXTERNAL,
                   SUBMODE$STEP$SW$ENABLE ADDRESS EXTERNAL,
                   DNV$LAST$WAYPT$PTR ADDRESS EXTERNAL,
                   DIGIT$KB$GRID BYTE EXTERNAL,
                   DIGIT$KB$TABLEAU BYTE EXTERNAL;
```

```
 35  1      DECLARE WAYPT$PTR ADDRESS;
            /* UNPACKED WAYPOINT DATA STRUCTURE */
 36  1      DECLARE WAYPT BASED WAYPT$PTR STRUCTURE(
              STATUS BYTE,
              UTM$SPHEROID BYTE,
              UTM$ZONE(2) BYTE,
              UTM$ALPHA(3) BYTE,
              UTM$VALUE(8) BYTE,
              LAT(6) BYTE,
              LON(7) BYTE,
              MAGVAR(6) BYTE);

            /* PACKED WAYPOINT DATA STRUCTURE.
              NOTE: THIS DATA OVERLAYS RMBUFB. */
 37  1      DECLARE LAST$WAYPT BASED DNV$LAST$WAYPT$PTR STRUCTURE(
              STATUS(2) BYTE,
              UTM(28) BYTE,
              LL(26) BYTE,
              MAGVAR(12) BYTE);




 38  1      DISPLAY$WAYPT$TYPE: PROCEDURE(TYPE) PUBLIC;
 39  2      DECLARE TYPE BYTE,
              I BYTE;
            /* TYPE FORMAT:
              BIT0: 0 - CXPT, 1 - TGT,
              BIT1: 0 - L/L,  1 - UTM */
 40  2      DECLARE WPT$ROW(2) BYTE DATA(4,6),
              WPT$COL(2) BYTE DATA(6,2);
 41  2      DECLARE WPT$TEXT(2) STRUCTURE(CH(4) BYTE) DATA('CXPTTGT ');
 42  2      DECLARE COORD$TEXT(2) STRUCTURE(CH(3) BYTE) DATA('UTM/L/L'),
              COORD$COL(2) BYTE DATA(6,12);

 43  2        I = TYPE AND 1;
 44  2        CALL UPDATE$LINE(WPT$ROW(I),WPT$COL(I),4,.WPT$TEXT(I));
 45  2        I = SHR(TYPE,1) AND 1;
 46  2        CALL UPDATE$LINE(6,COORD$COL(I),3,.COORD$TEXT(I));
 47  2      END;
```

```
                $EJECT
 48  1      DECLARE LAT$TABLEAU(*) BYTE DATA(
              ROW1,'ENTER LATITUDE',
              ROW2,COL19,'N',
              ROW6,COL19,'S',
              ROW8,COL16,'C',COL22,'E',0);
 49  1      DECLARE LAT$DIR$ICB STRUCTURE(
              MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
              ECHO$ROW BYTE, ECHO$COL BYTE, SW$ENABLE ADDRESS) DATA(
              NORTH$SOUTH,1,0,0,2,0,.SUBMODE$STEP$SW$ENABLE);
 50  1      DECLARE LAT$VAL$ICB STRUCTURE(
              MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
              ECHO$ROW BYTE, ECHO$COL BYTE,SW$ENABLE ADDRESS) DATA(
              DIGIT,5,' ',2800H,2,2,.SUBMODE$STEP$SW$ENABLE);
 51  1      DECLARE LON$TABLEAU(*) BYTE DATA(
              ROW1,COL6,'LONGITUDE',
              ROW4,COL16,'E',COL22,'W',
              ROW8,COL16,'C',COL22,'E',0);
 52  1      DECLARE LON$DIR$ICB STRUCTURE(
              MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
              ECHO$ROW BYTE, ECHO$COL BYTE, SW$ENABLE ADDRESS) DATA(
              EAST$WEST,1,0,0,2,0,.SUBMODE$STEP$SW$ENABLE);
 53  1      DECLARE LON$VAL$ICB STRUCTURE(
              MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
              ECHO$ROW BYTE, ECHO$COL BYTE, SW$ENABLE ADDRESS) DATA(
              DIGIT,6,' ',1400H,2,1,.SUBMODE$STEP$SW$ENABLE);
 54  1      DECLARE LAT$MAX(*) BYTE DATA('900'),
              LON$MAX(*) BYTE DATA('180');


 55  1      GET$DATA: PROCEDURE(CNTL$PTR,DATA$PTR,DATA$TYPE,WAYPT$TYPE);
             /* READ LAT OR LON DIRECTION AND VALUE ENTRIES. */
 56  2      DECLARE CNTL$PTR ADDRESS,
              DATA$PTR ADDRESS,
              DATA$TYPE BYTE, /* 0 - LAT, 1 - LON */
              WAYPT$TYPE BYTE;
 57  2      DECLARE (DAT BASED DATA$PTR)(1) BYTE;
 58  2      DECLARE CNTL BASED CNTL$PTR STRUCTURE(
              MAX$ADD ADDRESS,
              TAB$ADD ADDRESS,
              DIR$ICB$ADD ADDRESS,
              VAL$ICB$ADD ADDRESS);
 59  2      DECLARE ETAB(*) BYTE DATA(ROW2,COL4,DEG$SYM,COL7,'.',COL9,'''',0);

 60  2         CALL CLEAR(2);
 61  2         CALL DISPLAY$WAYPT$TYPE(WAYPT$TYPE);
 62  2         CALL GRID(.DIGIT$KB$GRID);
 63  2         CALL DISPLAY(CNTL.TAB$ADD);
 64  2      A:
              CALL READ(CNTL.DIR$ICB$ADD);        /* DIRECTION */
 65  2         IF (SWV = SUBMODE$SW) OR (SWV = STEP$SW) THEN RETURN;
 67  2         IF NOT DATA$ENTERED THEN GO TO A;   /* REJECT <ENTER> NOT PRECEEDED BY DATA */
 69  2         DAT(0) = IN$BUF(0);
 70  2         CALL UPDATE$LINE(2,0,1,.IN$BUF);    /* PUT DIR BACK ON THE DISPLAY */
 71  2         CALL DISPLAY(.DIGIT$KB$TABLEAU);
 72  2         CALL DISPLAY(.ETAB);
             /* INPUT DEGREES VALUE */
```

```
 73  2      B:
              CALL READ(CNTL.VAL$ICB$ADD);
 74  2        IF (SWV = SUBMODE$SW) OR (SWV = STEP$SW) THEN RETURN;
 76  2        IF NOT DATA$ENTERED THEN GO TO B;
 78  2        IF LIMIT$TEST(.IN$BUF,2+DATA$TYPE,.ZERO,CNTL.MAX$ADD) AND
                LIMIT$TEST(.IN$BUF(2+DATA$TYPE),3,.ZERO,.LAT$MAX) THEN
 79  2          CALL MOVE(5+DATA$TYPE,.IN$BUF,DATA$PTR+1);
 80  2        ELSE DO;
 81  3          CALL ERROR(0);    /* INVALID ENTRY */
 82  3          GO TO B;
 83  3          END;
 84  2      END;   /* OF GET$DATA */


 85  1      LAT$LON$DATA$ENTRY: PROCEDURE(WAYPT$ADD,WAYPT$TYPE) BYTE;
 86  2      DECLARE WAYPT$ADD ADDRESS,
                WAYPT$TYPE ADDRESS; /* 0 - CKPT, 1 - TGT */
 87  2      DECLARE CNTL(2) STRUCTURE(
                MAX$ADD ADDRESS,
                TAB$ADD ADDRESS,
                DIR$ICB$ADD ADDRESS,
                DEG$ICB$ADD ADDRESS) DATA(
                .LAT$MAX,.LAT$TABLEAU,.LAT$DIR$ICB,.LAT$VAL$ICB,
                .LON$MAX,.LON$TABLEAU,.LON$DIR$ICB,.LON$VAL$ICB);


 88  2        WAYPT$PTR = WAYPT$ADD;
 89  2        CALL GET$DATA(.CNTL(0),.WAYPT.LAT,0,WAYPT$TYPE);
 90  2        IF SWV = SUBMODE$SW THEN RETURN(0);
 92  2        IF SWV = STEP$SW THEN RETURN(80H);

 94  2        CALL GET$DATA(.CNTL(1),.WAYPT.LON,1,WAYPT$TYPE);
 95  2        IF SWV = SUBMODE$SW THEN RETURN(0);
 97  2        IF SWV = STEP$SW THEN RETURN(80H);
 99  2        WAYPT.STATUS = WAYPT.STATUS OR 4;
100  2        RETURN(1);  /* NORMAL RETURN */
101  2      END;   /* OF LAT$LON$DATA$ENTRY */
```

```
                $EJECT
102   1         MAGVAR$DATA$ENTRY: PROCEDURE(WAYPT$ADD,WAYPT$TYPE) BYTE;
103   2         DECLARE WAYPT$ADD ADDRESS,
                    WAYPT$TYPE BYTE;

104   2         DECLARE MAGVAR$TABLEAU(*) BYTE DATA(
                    ROW1,'ENTER MAG VAR',
                    ROW4,COL16,'E',COL22,'W',
                    ROW9,COL16,'C',COL22,'E',0);
105   2         DECLARE CNTL STRUCTURE(
                    MAX$ADD ADDRESS,
                    TAB$ADD ADDRESS,
                    DIR$ICB$ADD ADDRESS,
                    VAL$ICB$ADD ADDRESS) DATA(.LAT$MAX,.MAGVAR$TABLEAU,.LON$DIR$ICB,.LAT$VAL$ICB);


106   2           WAYPT$PTR = WAYPT$ADD;
107   2           CALL CLEAR(1);
108   2           CALL DISPLAY$WAYPT$TYPE(WAYPT$TYPE);
109   2           CALL GRID(.DIGIT$KE$GRID);
110   2           CALL DISPLAY(.MAGVAR$TABLEAU);
111   2           CALL GET$DATA(.CNTL,.WAYPT.MAGVAR,0,WAYPT$TYPE);
112   2           IF SW# = SUBMODE$SW THEN RETURN(0);
114   2           IF SW# = STEP$SW THEN RETURN(20H);
116   2           WAYPT.STATUS = WAYPT.STATUS OR 8;
117   2           RETURN(1);

118   2         END;   /* OF MAGVAR$DATA$ENTRY */
```

```
                $EJECT
119   1     DNV$COORD$DATA$ENTRY: PROCEDURE(WAYPT$ADD,WAYPT$TYPE) BYTE PUBLIC;
120   2     DECLARE WAYPT$ADD ADDRESS, /* MUST POINT TO AN UNPACKED WAYPOINT DATA BLOCK */
                WAYPT$TYPE BYTE;    /* SEE DISPLAY$WAYPT$TYPE FOR FORMAT DESCIRPTION*/
121   2     DECLARE COORD$TABLEAU(*) BYTE DATA(
                ROW2,'SELECT COORDINATE SYSTEM',
                ROW5,COL6,'UTM',COL12,'L/L',0);
122   2     DECLARE COORD$SW$ENABLE STRUCTURE(
                SW$MASK(7) BYTE,
                SW$VALUE(2) BYTE) DATA(
                0,0,0,28H,0,0,88H,
                01H,20H);
123   2     DECLARE COORD$ICB STRUCTURE(
                MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
                ECHO$ROW BYTE, ECHO$COL BYTE, SW$ENABLE ADDRESS) DATA(
                SWITCH,0,0,0,0,0,.COORD$SW$ENABLE);
124   2     DECLARE RET$FLAG BYTE;


125   2       CALL CLEAR(2);
126   2       CALL DISPLAY(.COORD$TABLEAU);
127   2       CALL DISPLAY$WAYPT$TYPE(WAYPT$TYPE);
128   2       CALL GRID(.SUBMODE$GRID);
129   2       CALL READ(.COORD$ICB);
130   2       IF SW# = SUBMODE$SW THEN RETURN(0);
132   2       IF SW# = STEP$SW THEN DO;
134   3         RET$FLAG = 0E0H;  /* COPY ALL DATA FROM LAST WAYPOINT */
135   3         GO TO A;
136   3         END;
137   2       WAYPT$TYPE = WAYPT$TYPE + SHL(SW$INDEX,1);
138   2       IF SW$INDEX THEN RET$FLAG = LAT$LON$DATA$ENTRY(WAYPT$ADD,WAYPT$TYPE);
140   2                   ELSE RET$FLAG = DNV$UTM$DATA$ENTRY(WAYPT$ADD,WAYPT$TYPE);
141   2       IF RET$FLAG = 0 THEN RETURN(0);
143   2       RET$FLAG = RET$FLAG OR MAGVAR$DATA$ENTRY(WAYPT$ADD,WAYPT$TYPE);
144   2       IF RET$FLAG = 0 THEN RETURN(0);

              /* IN EACH OF THE ABOVE DATA ENTRY PROCEDURES THE STEP SWITCH IS ENABLED
                 AT CERTAIN POINTS, WHICH IF PRESSED SIGNIFIES THAT DATA FROM AN EARLIER
                 OR PREVIOUS WAYPOINT IS TO BE COPIED INTO THE ONE CURRENTLY UNDER
                 CONSIDERATION, THUS SAVING THE OPERATOR A FEW KEYSTROKES.
                 THE FORMAT OF THE RETURN FLAG IS:
                 BIT 7 - LAT$LON$DATA$ENTRY
                 BIT 6 - UTM$DATA$ENTRY
                 BIT 5 - MAGVAR$DATA$ENTRY
                 IF ALL DATA WAS ENTERED NORMALLY THE RETURN FLAG HAS A VALUE OF ONE (1).
                 IF THE SUBMODE SWITCH WAS PRESSED, THE RETURN FLAG HAS A VALUE OF ZERO (0).
              */

146   2       IF RET$FLAG = 1 THEN RETURN(1);
148   2     A:
                WAYPT$PTR = WAYPT$ADD;
149   2       IF (RET$FLAG AND 40H) > 0 THEN DO;
151   3         CALL UNPACK$WAYPT(13,.LAST$WAYPT.UTM,.WAYPT.UTM$SPHEROID);
152   3         WAYPT.STATUS = WAYPT.STATUS OR 2;
153   3         END;
154   2       IF (RET$FLAG AND 80H) > 0 THEN DO;
156   3         CALL UNPACK$WAYPT(13,.LAST$WAYPT.LL,.WAYPT.LAT);
```

```
157  3          WAYPT.STATUS = WAYPT.STATUS OR 4;
158  3          END;
159  2        IF (RET$FLAG AND 20H) > 0 THEN DO;
161  3          CALL UNPACK$WAYPT(6,.LAST$WAYPT.MAGVAR,.WAYPT.MAGVAR);
162  3          WAYPT.STATUS = WAYPT.STATUS OR 8;
163  3          END;
164  2        RETURN(1);

165  2      END;  /* OF COORD */


166  1      END;  /* OF DNV2 */
```

MODULE INFORMATION:

```
    CODE AREA SIZE     = 044CH   1100D
    VARIABLE AREA SIZE = 0015H     21D
    MAXIMUM STACK SIZE = 000CH     12D
    339 LINES READ
    0 PROGRAM ERROR(S)

END OF PL/M-80 COMPILATION
```

```
ISIS-II PL/M-80 V3.0 COMPILATION OF MODULE DNV3
OBJECT MODULE PLACED IN :F1:DNV3.OBJ
COMPILER INVOKED BY:  PLM80 :F1:DNV3.SRC DATE(8MAR79) DEBUG


                $TITLE('DNV3')
                 /* DNV$UPDATE */
     1           DNV3: DO;
                $NOLIST INCLUDE(:F1:CDULIT.SRC)
     4    1      DISPLAY$ACTIVE$WAYPT: PROCEDURE EXTERNAL;
     5    2      END;
     6    1      DISPLAY$PRESENT$POSITION: PROCEDURE(ROW) EXTERNAL;
     7    2      DECLARE ROW BYTE;
     8    2      END;
     9    1      DNV$COORD$DATA$ENTRY: PROCEDURE(WAYPT$PTR,WAYPT$TYPE) BYTE EXTERNAL;
    10    2      DECLARE WAYPT$PTR ADDRESS, WAYPT$TYPE BYTE;
    11    2      END;
    12    1      CLEAR: PROCEDURE(START$ROW) EXTERNAL;
    13    2      DECLARE START$ROW BYTE;
    14    2      END;
    15    1      ERROR: PROCEDURE(CODE) EXTERNAL;
    16    2      DECLARE CODE BYTE;
    17    2      END;
    18    1      GRID: PROCEDURE(POINTER) EXTERNAL;
    19    2      DECLARE POINTER ADDRESS;
    20    2      END;
    21    1      DISPLAY: PROCEDURE(IN$PTR) EXTERNAL;
    22    2      DECLARE IN$PTR ADDRESS;
    23    2      END;
    24    1      DISPLAY$DIGIT$KB: PROCEDURE EXTERNAL;
    25    2      END;
    26    1      READ: PROCEDURE(ICB$PTR) EXTERNAL;
    27    2      DECLARE ICB$PTR ADDRESS;
    28    2      END;
    29    1      UPDATE$LINE: PROCEDURE(ROW,COL,NCHAR,TEXT$PTR) EXTERNAL;
    30    2      DECLARE (ROW,COL,NCHAR) BYTE, TEXT$PTR ADDRESS;
    31    2      END;
    32    1      UNPACK$WAYPT: PROCEDURE(NBYTES,SOURCE$PTR,DEST$PTR) EXTERNAL;
    33    2      DECLARE NBYTES BYTE, (SOURCE$PTR, DEST$PTR) ADDRESS;
    34    2      END;


                /* EXTERNAL VARIABLES */
    35    1      DECLARE
                     OFF$ON$TEXT(6) BYTE EXTERNAL,
                     BLANK$LINE(24) BYTE EXTERNAL,
                     DATA$ENTERED BYTE EXTERNAL,
                     IN$BUF(1) BYTE EXTERNAL,
                     SWV BYTE EXTERNAL,
                     SW$INDEX BYTE EXTERNAL,
                     SUBMODE$GRID BYTE EXTERNAL,
                     SUBMODE$SW$ENABLE BYTE EXTERNAL,
                     DNV$CKPT$DATA(10) STRUCTURE(DIGITS(68) BYTE) EXTERNAL,

                     DNV$TEMP$WAYPT STRUCTURE(
                       STATUS BYTE,
```

```
                UTM$SPHEROID BYTE,
                UTM$ZONE(2) BYTE,
                UTM$ALPHA(3) BYTE,
                UTM$VALUE(8) BYTE,
                LATITUDE(6) BYTE,
                LONGITUDE(7) BYTE,
                MAGVAR(6) BYTE) EXTERNAL;

 36  1      DNV$UPDATE: PROCEDURE PUBLIC;
 37  2      DECLARE TAB1(*) BYTE DATA(
               ROW0,'DNV',COL9,'UPDATE',
               ROW4,COL6,'CKPT',
               ROW7,COL7,'UP',
               ROW8,COL6,'DATE',0);
 38  2      DECLARE ENABLE1 STRUCTURE(
               SW$MASK(7) BYTE,
               SW$VALUE(2) BYTE) DATA(
               0,0,20H,0,20H,0,80H,    /* CKPT, UPDATE, SUBMODE */
               01H,20H);
 39  2      DECLARE ICB1 STRUCTURE(
               MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
               ECHO$ROW BYTE, ECHO$COL BYTE, SW$ENABLE ADDRESS) DATA(
               SWITCH,0,0,0,0,0,.ENABLE1);
 40  2      DECLARE TAB2(*) BYTE DATA(ROW2,'ENTER CKPT',0);
 41  2      DECLARE ICB2 STRUCTURE(
               MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
               ECHO$ROW BYTE, ECHO$COL BYTE, SW$ENABLE ADDRESS) DATA(
               DIGIT,1,0,0,2,11,.SUBMODE$SW$ENABLE);
 42  2       DECLARE FRZE$TAB(*) BYTE DATA(ROW4,' FRZE',0);
 43  2      DECLARE FRZE$ENABLE STRUCTURE(
               SW$MASK(7) BYTE,
               SW$VALUE(1) BYTE) DATA(
               0,0,80H,0,0,0,80H,  /* FRZE, SUBMODE */
               01H);
 44  2      DECLARE FRZE$ICB STRUCTURE(
               MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
               ECHO$ROW BYTE, ECHO$COL BYTE, SW$ENABLE ADDRESS) DATA(
               SWITCH,0,0,0,0,0,.FRZE$ENABLE);
 45  2      DECLARE UPDATE$TAB(*) BYTE DATA(
               ROW2,'UPDATE DIST 12.3',
               ROW7,COL7,'UP',
               ROW8,COL6,'DATE',0);
 46  2      DECLARE UPDATE$ENABLE STRUCTURE(
               SW$MASK(7) BYTE,
               SW$VALUE(1) BYTE) DATA(
               0,0,0,0,20H,0,80H,  /* UPDATE, SUBMODE */
               01H);
 47  2      DECLARE UPDATE$ICB STRUCTURE(
               MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
               ECHO$ROW BYTE, ECHO$COL BYTE, SW$ENABLE ADDRESS) DATA(
               SWITCH,0,0,0,0,0,0,.UPDATE$ENABLE);
 48  2      DECLARE NEW$FRZE$TAB(*) BYTE DATA(
               ROW4,' FRZE',
               ROW8,' NEW',0);
 49  2      DECLARE NEW$FRZE$ENABLE STRUCTURE(
               SW$MASK(7) BYTE,
               SW$VALUE(2) BYTE) DATA(
```

```
                  0,0,80H,0,80H,0,80H,    /* NEW, FRZE, SUBMODE */
                  01H,20H);
 50  2        DECLARE NEW$FRZE$ICB STRUCTURE(
                  MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
                  ECHO$ROW BYTE, ECHO$COL BYTE, SW$ENABLE ADDRESS) DATA(
                  SWITCH,0,0,0,0,0,.NEW$FRZE$ENABLE);
 51  2        DECLARE I BYTE;


 52  2        TOP:
                  CALL CLEAR(0);
 53  2          CALL DISPLAY$ACTIVE$WAYPT;
 54  2          CALL DISPLAY$PRESENT$POSITION(2);
 55  2          CALL DISPLAY(.TAB1);
 56  2          CALL GRID(.SUBMODE$GRID);
 57  2          CALL READ(.ICB1);
 58  2          DO CASE SW$INDEX;
 59  3            GO TO A;  /* CKPT SWITCH PRESSED */
 60  3            GO TO C;  /* UPDATE SWITCH PRESSED */
 61  3            RETURN;   /* SUBMODE */
 62  3            END;
 63  2        A:
                  CALL CLEAR(2);
 64  2          CALL DISPLAY(.TAB2);    /* "ENTER CKPT" */
 65  2          CALL DISPLAY$DIGIT$KB;
 66  2        B:
                  CALL READ(.ICB2);   /* CKPT NUMBER */
 67  2          IF SWV = SUBMODE$SW THEN RETURN;
 68  2          IF NOT DATA$ENTERED THEN DO;
 71  3            CALL ERROR(0);    /* "INVALID ENTRY" */
 72  3            GO TO B;
 73  3            END;
 74  2          I = IN$BUF(0) - 30H;
 75  2          CALL UNPACK$WAYPT(34,.DNV$CKPT$DATA(I),.DNV$TEMP$WAYPT);
 76  2          IF (DNV$TEMP$WAYPT.STATUS AND 6) = 0 THEN DO;
 78  3            CALL ERROR(2);    /* "NO DATA FOR THIS CKPT" */
 79  3            GO TO B;
 80  3            END;
                /* CKPT SELECTED, WAIT FOR FRZE */
 81  2          CALL CLEAR(2);
 82  2          CALL DISPLAY(.FRZE$TAB);
 83  2          CALL GRID(.SUBMODE$GRID);
 84  2          CALL READ(.FRZE$ICB);
 85  2          IF SWV = SUBMODE$SW THEN RETURN;
                /* FRZE ENTERED, WAIT FOR UPDATE */
 87  2          CALL CLEAR(2);
 88  2          CALL DISPLAY(.UPDATE$TAB);
 89  2          CALL READ(.UPDATE$ICB);
 90  2          RETURN;         /* DONE */

 91  2        C:     /* UPDATE SWITCH PRESSED FIRST */
                  CALL CLEAR(2);
 92  2          CALL DISPLAY(.NEW$FRZE$TAB);
 93  2          CALL READ(.NEW$FRZE$ICB);
 94  2          DO CASE SW$INDEX;
 95  3            GO TO E;  /* FRZE */
 96  3            GO TO D;  /* NEW */
```

```
 97  3          RETURN;   /* SUBMODE */
 98  3          END;
 99  2      G:
            /* NEW SWITCH PRESSED, ENTER COORDINATES */
               IF DNV$COORD$DATA$ENTRY(.DNV$TEMP$WAYPT.CKPT) = 0  THEN RETURN;
            /* DATA ENTERED, WAIT FOR FRIE */
101  2         CALL CLEAR(2);
102  2         CALL DISPLAY(.FRIE$TAB);
103  2         CALL GRID(.SUBMODE$GRID);
104  2         CALL READ(.FRIE$ICB);
105  2         IF SW# = SUBMODE$SW THEN RETURN;
107  2         GO TO F;
108  2      E:
            /* FRIE ENTERED BEFOR NEW */
               IF DNV$COORD$DATA$ENTRY(.DNV$TEMP$WAYPT.CKPT) = 0 THEN RETURN;
110  2      F:
               CALL CLEAR(1);
111  2         CALL DISPLAY(.UPDATE$TAB);
112  2         CALL GRID(.SUBMODE$GRID);
113  2         CALL READ(.UPDATE$ICB);
114  2         IF SW#INDEX = 0 THEN GO TO TOP;

116  2      END;   /* OF UPDATE */


117  1      END;   /* OF DNV3 */
```

MODULE INFORMATION:

```
    CODE AREA SIZE     = 0204H    516D
    VARIABLE AREA SIZE = 0001H     1D
    MAXIMUM STACK SIZE = 0004H     4D
    248 LINES READ
    0 PROGRAM ERROR(S)
```

END OF PL/M-80 COMPILATION

```
ISIS-II PL/M-80 V3.1 COMPILATION OF MODULE DNV4
OBJECT MODULE PLACED IN :F1:DNV4.OBJ
COMPILER INVOKED BY:  PLM80 :F1:DNV4.SRC DATE(1NOV79) DEBUG


                $TITLE('DNV4')
                 /* FORMAT$WAYPT$COORD, DNV$WAYPT$STATUS, DNV$BACKUP$NAV */
  1             DNV4: DO;
                $NOLIST INCLUDE(:F1:COULIT.SRC)
  4   1         DISPLAY$ACTIVE$WAYPT: PROCEDURE EXTERNAL;
  5   2         END;
  6   1         CLEAR: PROCEDURE(ROW) EXTERNAL;
  7   2         DECLARE ROW BYTE;
  8   2         END;
  9   1         DISPLAY: PROCEDURE(PTR) EXTERNAL;
 10   2         DECLARE PTR ADDRESS;
 11   2         END;
 12   1         UPDATE$LINE: PROCEDURE(ROW,COL,NBYTES,TEXT$PTR) EXTERNAL;
 13   2         DECLARE (ROW,COL,NBYTES) BYTE, TEXT$PTR ADDRESS;
 14   2         END;
 15   1         DISPLAY$DIGIT$KB: PROCEDURE EXTERNAL;
 16   2         END;
 17   1         GRID: PROCEDURE(PTR) EXTERNAL;
 18   2         DECLARE PTR ADDRESS;
 19   2         END;
 20   1         READ: PROCEDURE(ICB$PTR) EXTERNAL;
 21   2         DECLARE ICB$PTR ADDRESS;
 22   2         END;
 23   1         INSERT: PROCEDURE(NCHAR,SOURCE$PTR,DEST$PTR,DELM$CH,DELM$MASK) EXTERNAL;
 24   2         DECLARE (NCHAR,DELM$CH) BYTE, (SOURCE$PTR,DEST$PTR,DELM$MASK) ADDRESS;
 25   2         END;
 26   1         PACK$WAYPT: PROCEDURE(COUNT,SOURCE$PTR,DEST$PTR) EXTERNAL;
 27   2         DECLARE COUNT BYTE, (SOURCE$PTR, DEST$PTR) ADDRESS;
 28   2         END;
 29   1         UNPACK$WAYPT: PROCEDURE(COUNT,SOURCE$PTR,DEST$PTR) EXTERNAL;
 30   2         DECLARE COUNT BYTE, (SOURCE$PTR, DEST$PTR) ADDRESS;
 31   2         END;
 32   1         CLEAR$TEMP$BUF: PROCEDURE EXTERNAL;
 33   2         END;
 34   1         DNV$COORD$DATA$ENTRY: PROCEDURE(WAYPT$PTR,WAYPT$TYPE) BYTE EXTERNAL;
 35   2         DECLARE WAYPT$PTR ADDRESS, WAYPT$TYPE BYTE;
 36   2         END;

                /* EXTERNAL VARIABLES */
 37   1         DECLARE
                   SWV BYTE EXTERNAL,
                   SW$INDEX BYTE EXTERNAL,
                   IN$BUF(1) BYTE EXTERNAL,
                   DATA$ENTERED BYTE EXTERNAL,
                   TEMP$BUF(1) BYTE EXTERNAL,
                   SUBMODE$GRID BYTE EXTERNAL,
                   SUBMODE$SW$ENABLE BYTE EXTERNAL,
                   SPHEROID$TEXT(6) STRUCTURE(CH(3) BYTE) EXTERNAL,

                   DNV$TEMP$WAYPT STRUCTURE(
                     STATUS BYTE,
```

```
                UTM$SPHEROID BYTE,
                UTM$ZONE(2) BYTE,
                UTM$ALPHA(1) BYTE,
                UTM$VALUE(8) BYTE,
                LATITUDE(6) BYTE,
                LONGITUDE(7) BYTE,
                MAGVAR(6) BYTE) EXTERNAL,

               DNV$STATUS BYTE EXTERNAL,
               DNV$DESTINATION BYTE EXTERNAL,
               DNV$CKPT$DATA BYTE EXTERNAL,
               DNV$TGT$DATA BYTE EXTERNAL,
               DNV$LAST$WAYPT$PTR ADDRESS EXTERNAL,
               DNV$WIND$DIR BYTE EXTERNAL,
               DNV$WIND$SPEED(3) BYTE EXTERNAL,
               DNV$GROUND$SPEED(3) BYTE EXTERNAL,
               DNV$TRACK$ANGLE(3) BYTE EXTERNAL;

 38  1     DECLARE WAYPT$BASE$ADD ADDRESS,
             (PACKED$WAYPT BASED WAYPT$BASE$ADD)(10) STRUCTURE(CH(68) BYTE);
```

```
                $EJECT
 39  1      FORMAT$WAYPT$COORD: PROCEDURE(WAYPT$ADD) PUBLIC;
 40  2      DECLARE WAYPT$ADD ADDRESS; /* MUST POINT TO AN UNPACKED WAYPOINT DATA BLOCK */
 41  2      DECLARE WAYPT BASED WAYPT$ADD STRUCTURE(
               STATUS BYTE,
               UTM$SPHEROID BYTE,
               UTM$ZONE(2) BYTE,
               UTM$ALPHA(3) BYTE,
               UTM$VALUE(8) BYTE,
               LATITUDE(6) BYTE,
               LONGITUDE(7) BYTE,
               MAGVAR(6) BYTE);
 42  2      DECLARE ERROR$MSG(*) BYTE DATA('DATA NOT AVAILABLE');

 43  2      FORMAT$LAT$LON: PROCEDURE;

 44  3         CALL INSERT(6,.WAYPT.LATITUDE,.TEMP$BUF(3),'.',1200H);
 45  3         CALL INSERT(7,.WAYPT.LONGITUDE,.TEMP$BUF(14),'.',0900H);
 46  3         TEMP$BUF(6),TEMP$BUF(18) = DEG$SYM;
 47  3         TEMP$BUF(11),TEMP$BUF(23) = '''';

 48  3      END;

 49  2      FORMAT$UTM: PROCEDURE;

 50  3         CALL MOVE(3,.SPHEROID$TEXT(WAYPT.UTM$SPHEROID AND 0FH),.TEMP$BUF(3));
 51  3         CALL INSERT(13,.WAYPT.UTM$ZONE,.TEMP$BUF(7),' ',2210H);
 52  3      END;


 53  2         IF DNV$STATUS THEN DO;
 55  3           IF (WAYPT.STATUS AND 2) > 0 THEN CALL FORMAT$UTM;
 57  3           ELSE DO;
 58  4             IF (WAYPT.STATUS AND 4) > 0 THEN CALL FORMAT$LAT$LON;
 60  4             ELSE CALL MOVE(18,.ERROR$MSG,.TEMP$BUF(3));
 61  4             END;
 62  3           END;
 63  2         ELSE DO;
 64  3            IF (WAYPT.STATUS AND 4) > 0 THEN CALL FORMAT$LAT$LON;
 66  3            ELSE DO;
 67  4              IF (WAYPT.STATUS AND 2) > 0 THEN CALL FORMAT$UTM;
 69  4              ELSE CALL MOVE(18,.ERROR$MSG,.TEMP$BUF(3));
 70  4              END;
 71  3            END;
 72  2      END;  /* OF FORMAT$WAYPT$COORD */
```

```
                $EJECT
 73  1          DNV$WAYPT$STATUS: PROCEDURE(TYPE) PUBLIC;
 74  2          DECLARE TYPE BYTE; /* 0 == CKPT, 1 == TGT */

 75  2          DECLARE STAT$TABLEAU(*) BYTE DATA(
                   ROW0,'DNV',
                   ROW1,COL22,'/3',0);
 76  2          DECLARE TYPE$TABLEAU(2) STRUCTURE(TEXT(7) BYTE) DATA(
                   ROW0,COL6,'CKPT',0,
                   ROW0,COL6,' TGT',0);
 77  2          DECLARE PAGE12$STAT$SW$ENABLE STRUCTURE(
                   SW$MASK(7) BYTE,
                   SW$ENABLE(2) BYTE) DATA(
                   0,80H,80H,80H,80H,0,88H, /* SWV = 100,200,300,400,SUBMODE, STEP */
                   01H,23H);
 78  2          DECLARE PAGE12$STAT$ICB STRUCTURE(
                   MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
                   ECHO$ROW BYTE, ECHO$COL BYTE, SW$ENABLE ADDRESS) DATA(
                   SWITCH,0,0,0,0,0,.PAGE12$STAT$SW$ENABLE);
 79  2          DECLARE PAGE3$STAT$SW$ENABLE STRUCTURE(
                   SW$MASK(7) BYTE,
                   SW$VALUE(1) BYTE) DATA(
                   0,80H,80H,0,0,0,88H,     /* SWV = 100,200,SUBMODE,STEP */
                   01H);
 80  2          DECLARE PAGE3$STAT$ICB STRUCTURE(
                   MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
                   ECHO$ROW BYTE, ECHO$COL BYTE, SW$ENABLE ADDRESS) DATA(
                   SWITCH,0,0,0,0,0,0,.PAGE3$STAT$SW$ENABLE);
 81  2          DECLARE PAGE$SIZE(3) BYTE DATA(3,3,1), /* MINUS ONE */
                   WAYPT$NUM BYTE,
                   WAYPT$OFFSET BYTE,
                   STAR$ENABLE BYTE,
                   ACTIVE$WAYPT BYTE,
                   (PAGE,I,N) BYTE;



 82  2          IF TYPE = CKPT THEN WAYPT$BASE$ADD = .DNV$CKPT$DATA;
 84  2                         ELSE WAYPT$BASE$ADD = .DNV$TGT$DATA;
 85  2          STAR$ENABLE = NOT (TYPE XOR DNV$DESTINATION);
 86  2          ACTIVE$WAYPT = SHR(DNV$DESTINATION,1) AND 0FH;
 87  2          PAGE = 0;
 88  2          WAYPT$OFFSET = 0;
 89  2          DO FOREVER;
 90  3            CALL CLEAR(0);
 91  3            CALL DISPLAY$ACTIVE$WAYPT;
 92  3            CALL DISPLAY(.TYPE$TABLEAU(TYPE));
 93  3            CALL DISPLAY(.STAT$TABLEAU);
 94  3            N = PAGE$SIZE(PAGE);
 95  3            TEMP$BUF(0) = PAGE + 31H;
 96  3            CALL UPDATE$LINE(1,21,1,.TEMP$BUF);
 97  3            CALL CLEAR(2);
 98  3            DO I = 0 TO N;
 99  4              CALL CLEAR$TEMP$BUF;
100  4              WAYPT$NUM = WAYPT$OFFSET + I;
101  4              TEMP$BUF(1) = WAYPT$NUM + 30H;
102  4              IF STAR$ENABLE AND (WAYPT$NUM = ACTIVE$WAYPT) THEN TEMP$BUF(2) = '*';
```

```
104  4            CALL UNPACK$WAYPT(34,.PACKED$WAYPT(WAYPT$NUM),.DNV$TEMP$WAYPT);
105  4            CALL FORMAT$WAYPT$COORD(.DNV$TEMP$WAYPT);
106  4            CALL UPDATE$LINE(I*2+2,0,24,.TEMP$BUF);
107  4            END;
108  3          IF PAGE < 3 THEN CALL READ(.PAGE12$STAT$ICB);
110  3                      ELSE CALL READ(.PAGE3$STAT$ICB);
111  3          IF SW = SUBMODE$SW THEN RETURN;
113  3          IF SW = STEP$SW THEN DO;
115  4            PAGE = (PAGE + 1) MOD 3;
116  4            WAYPT$OFFSET = PAGE*4;
117  4            END;
118  3          ELSE DO;
119  4            WAYPT$NUM = WAYPT$OFFSET + SW$INDEX;
120  4            IF DNV$COORD$DATA$ENTRY(.DNV$TEMP$WAYPT,TYPE) = 1 THEN DO;
122  5              CALL PACK$WAYPT(34,.DNV$TEMP$WAYPT,.PACKED$WAYPT(WAYPT$NUM));
123  5              DNV$LAST$WAYPT$PTR = .PACKED$WAYPT(WAYPT$NUM);
124  5              END;
125  4            END;
126  3          END;  /* OF DO FOREVER */

127  2      END;  /* OF DNV$WAYPT$STATUS */
```

```
                $EJECT
128   1         DNV$BACKUP$NAV: PROCEDURE PUBLIC;
129   2         DECLARE BACKUP$TABLE(*) BYTE DATA(
                    ROW0,'DNV',COL9,'BACKUP',
                    ROW3,' WIND WIND',COL11,'GSPD',
                    ROW4,' DIR',COL6,'SPD',
                    ROW5,' TRK',
                    ROW6,' ANG',0);
130   2         DECLARE BACKUP$SW$ENABLE STRUCTURE(
                    SW$MASK(7) BYTE,
                    SW$VALUE(3) BYTE) DATA(
                    0,0,0A0H,80H,0,0,80H,   /*WIND DIR,WIND SPD,GSPD,TRK,SUBMODE */
                    01H,23H,40H);
131   2         DECLARE BACKUP$ICB STRUCTURE(
                    MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
                    ECHO$ROW BYTE, ECHO$COL BYTE, SW$ENABLE ADDRESS) DATA(
                    SWITCH,0,0,0,0,0,.BACKUP$SW$ENABLE);
132   2         DECLARE BACKUP$DATA$ICB(4) STRUCTURE(
                    MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
                    ECHO$ROW BYTE, ECHO$COL BYTE, SW$ENABLE ADDRESS) DATA(
                    DIGIT,3,0,0,2,9,.SUBMODE$SW$ENABLE, /* WIND DIRECTION */
                    DIGIT,2,0,0,2,9,.SUBMODE$SW$ENABLE, /* WIND SPEED */
                    DIGIT,3,0,0,2,11,.SUBMODE$SW$ENABLE,    /* GROUND SPEED */
                    DIGIT,3,0,0,2,10,.SUBMODE$SW$ENABLE);   /* TRACK ANGLE */

133   2         DECLARE BACKUP$ENTRY$TAB(4) STRUCTURE(CH(13) BYTE) DATA(
                    ROW2,'WIND DIR   ',0,
                    ROW2,'WIND SPD   ',0,
                    ROW2,'GROUND SPD ',0,
                    ROW2,'TRACK ANGLE',0);
134   2         DECLARE NUM$DIGITS(4) BYTE DATA(3,2,3,3);
135   2         DECLARE DATA$ADD(4) ADDRESS DATA(
                    .DNV$WIND$DIR,
                    .DNV$WIND$SPEED,
                    .DNV$GROUND$SPEED,
                    .DNV$TRACK$ANGLE);
```

```
                $EJECT
136   2       BACKUP$DATA$ENTRY: PROCEDURE(I);
137   3       DECLARE I BYTE;

138   3          CALL CLEAR(2);
139   3          CALL DISPLAY(.BACKUP$ENTRY$TAB(I));
140   3          CALL DISPLAY$DIGIT$ICB;
141   3          CALL READ(.BACKUP$DATA$ICB(I));
142   3          IF SWV = SUBMODE$SW THEN RETURN;
144   3          IF DATA$ENTERED AND (SWV = ENTER$SW) THEN
145   3            CALL MOVE(NUM$DIGITS(I),.IN$BUF,DATA$ADD(I));
146   3       END;   /* OF BACKUP$DATA$ENTRY */



147   2       DISPLAY$STAT$LINE: PROCEDURE;
148   3       DECLARE STAT$TABLEAU(*) BYTE DATA(
                  ROW1,'W',COL4,'/',COL9,'TRK',COL17,'GSPD',0);
149   3       DECLARE LINE$LOC(4) ADDRESS DATA(
                  .TEMP$BUF+1,.TEMP$BUF+5,.TEMP$BUF+21,.TEMP$BUF+12);
150   3       DECLARE I BYTE;

151   3          CALL DISPLAY(.STAT$TABLEAU);
152   3          CALL CLEAR$TEMP$BUF;
153   3          DO I = 0 TO 3;
154   4            CALL MOVE(NUM$DIGITS(I),DATA$ADD(I),LINE$LOC(I));
155   4            END;
156   3          CALL UPDATE$LINE(1,0,24,.TEMP$BUF);

157   3       END;   /* OF DISPLAY$STAT$LINE */


                /* BEGIN BACKUP CODE */
158   2          DO FOREVER;
159   3            CALL CLEAR(0);
160   3            CALL DISPLAY$ACTIVE$WAYPT;
161   3            CALL DISPLAY$STAT$LINE;
162   3            CALL DISPLAY(.BACKUP$TABLEAU);
163   3            CALL GRID(.SUBMODE$GRID);
164   3            CALL READ(.BACKUP$ICB);
165   3            IF SWV = SUBMODE$SW THEN RETURN;
167   3            CALL BACKUP$DATA$ENTRY(SW$INDEX);
168   3            END;  /* OF DO FOREVER */
169   2       END;   /* DNV$BACKUP$W4V */

170   1       END;   /* OF DNV4 */


MODULE INFORMATION:

     CODE AREA SIZE     = 0491H   1169D
     VARIABLE AREA SIZE = 000EH     14D
     MAXIMUM STACK SIZE = 000CH     12D
     333 LINES READ
     0 PROGRAM ERROR(S)
```

END OF PL/M-80 COMPILATION

```
ISIS-II PL/M-80 V3.1 COMPILATION OF MODULE DNV5
OBJECT MODULE PLACED IN :F1:DNV5.OBJ
COMPILER INVOKED BY:  PLM80 :F1:DNV5.SRC DATE(1NOV79) DEBUG


                $TITLE('DNV5')
                 /* DNV$UTM$DATA$ENTRY, PACK$WAYPT, UNPACK$WAYPT */
  1             DNV5: DO;
  2  1          DECLARE HORZ LITERALLY 'OFEH',
                    VERT LITERALLY 'OFDH';
                $NOLIST INCLUDE(:F1:CDULIT.SRC)
  5  1          CLEAR: PROCEDURE(ROW) EXTERNAL;
  6  2          DECLARE ROW BYTE;
  7  2          END;
  8  1          DISPLAY: PROCEDURE(PTR) EXTERNAL;
  9  2          DECLARE PTR ADDRESS;
 10  2          END;
 11  1          UPDATE$LINE: PROCEDURE(ROW,COL,NCHAR,TEXT$PTR) EXTERNAL;
 12  2          DECLARE (ROW,COL,NCHAR) BYTE, TEXT$PTR ADDRESS;
 13  2          END;
 14  1          READ: PROCEDURE(ICB$PTR) EXTERNAL;
 15  2          DECLARE ICB$PTR ADDRESS;
 16  2          END;
 17  1          GRID: PROCEDURE(GRID$PTR) EXTERNAL;
 18  2          DECLARE GRID$PTR ADDRESS;
 19  2          END;
 20  1          DISPLAY$DIGIT$KB: PROCEDURE EXTERNAL;
 21  2          END;
 22  1          DISPLAY$WAYPT$TYPE: PROCEDURE(TYPE) EXTERNAL;
 23  2          DECLARE TYPE BYTE;
 24  2          END;
 25  1          DISPLAY$ACTIVE$WAYPT: PROCEDURE EXTERNAL;
 26  2          END;

                /* EXTERNAL VARIABLES */
 27  1          DECLARE
                   SW BYTE EXTERNAL,
                   SW$INDEX BYTE EXTERNAL,
                   IN$BUF(1) BYTE EXTERNAL,
                   DATA$ENTERED BYTE EXTERNAL,
                   SUBMODE$SW$ENABLE ADDRESS EXTERNAL,
                   SUBMODE$STEP$SW$ENABLE ADDRESS EXTERNAL,
                   SUBMODE$GRID ADDRESS EXTERNAL;


 28  1          DECLARE SPHEROID$TEXT(6) STRUCTURE(CH(3) BYTE) PUBLIC DATA('CLOEVOCL6EBOINOAUO');




 29  1          DNV$UTM$DATA$ENTRY: PROCEDURE(WAYPT$PTR,WAYPT$TYPE) BYTE PUBLIC;
 30  2          DECLARE WAYPT$PTR ADDRESS, /* MUST POINT TO AN UNPACKED WAYPT DATA BLOCK */
                   WAYPT$TYPE BYTE;

                /* UNPACKED WAYPOINT DATA BLOCK */
```

```
31  2     DECLARE WAYPT BASED WAYPT$PTR STRUCTURE(
            STATUS BYTE,
            UTM$SPHEROID BYTE,
            UTM$ZONE(2) BYTE,
            UTM$ALPHA(3) BYTE,
            UTM$VALUE(8) BYTE,
            LAT(6) BYTE,
            LON(7) BYTE,
            MAGVAR(6) BYTE);
32  2     DECLARE SPHEROID$TABLEAU(*) BYTE DATA(
            ROW0,'DNV',
            ROW2,'SELECT SPHEROID',
            ROW4,COL12,'CL0',COL17,'EV0',
            ROW6,COL12,'CL6',COL17,'BE0',
            ROW8,COL12,'IN0',COL17,'AU0',0);
33  2     DECLARE SPHEROID$SW$ENABLE STRUCTURE(
            SW$MASK(7) BYTE,
            SW$VALUE(6) BYTE) DATA(
            0,0,0EH,0EH,0EH,0,88H,  /* CL0,EV0,BE0,IN0,AU0,SUBMODE,STEP */
            01H,12H,33H,45H,56H,70H);
34  2     DECLARE SPHEROID$ICB STRUCTURE(
            MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
            ECHO$ROW BYTE, ECHO$COL BYTE, SW$ENABLE ADDRESS) DATA(
            SWITCH,0,0,0,0,0,.SPHEROID$SW$ENABLE);
35  2     DECLARE ZONE$ICB STRUCTURE(
            MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
            ECHO$ROW BYTE, ECHO$COL BYTE, SW$ENABLE ADDRESS) DATA(
            DIGIT,2,0,0,2,11,.SUBMODE$STEP$SW$ENABLE);
36  2     DECLARE ZONE$TABLEAU(*) BYTE DATA(ROW2,'ENTER ZONE',0);
37  2     DECLARE ALPHA$KB$TABLEAU(*) BYTE DATA(
            ROW2,COL1,'A',COL4,'B',COL7,'C',COL10,'D',COL13,'E',COL16,'F',COL19,'G',COL22,'H',
            ROW4,COL4,'J',COL7,'K',COL10,'L',COL13,'M',COL16,'N',COL22,'P',
            ROW6,COL1,'Q',COL4,'R',COL7,'S',COL10,'T',COL13,'U',COL16,'V',COL19,'W',COL22,'X',
            ROW8,COL1,'Y',COL4,'Z',COL16,'C',COL22,'E',0);
38  2     DECLARE ALPHA$KB$GRID(*) BYTE DATA(
            HORZ,4,14,22,32,42,52,62,72,82,92,
            HORZ,22,32,22,32,42,52,62,72,82,92,
            HORZ,40,50,22,32,42,52,62,72,82,92,
            HORZ,58,68,22,32,42,52,62,72,82,92,
            HORZ,76,86,22,32,42,52,62,72,82,92,
            HORZ,94,104,22,32,42,52,62,72,82,92,
            HORZ,112,122,22,32,42,52,62,72,82,92,
            HORZ,130,140,22,32,42,52,62,72,82,92,
            VERT,22,32,4,14,22,32,40,50,58,68,76,86,94,104,112,122,130,140,
            VERT,42,52,4,14,22,32,40,50,58,68,76,86,94,104,112,122,130,140,
            VERT,62,72,4,14,22,32,40,50,58,68,76,86,94,104,112,122,130,140,
            VERT,82,92,4,14,22,32,40,50,58,68,76,86,94,104,112,122,130,140,0FFH);
39  2     DECLARE ALPHA$ICB STRUCTURE(
            MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
            ECHO$ROW BYTE, ECHO$COL BYTE, SW$ENABLE ADDRESS) DATA(
            DMY$ALPHA,3,0,0,1,6,.SUBMODE$STEP$SW$ENABLE);
40  2     DECLARE VALUE$TABLEAU(*) BYTE DATA(ROW1, 'ENTER VALUE',0);
41  2     DECLARE VALUE$ICB STRUCTURE(
            MODE BYTE, NUM$CH BYTE, DELM$CH BYTE, DELM$MASK ADDRESS,
            ECHO$ROW BYTE, ECHO$COL BYTE, SW$ENABLE ADDRESS) DATA(
            DIGIT,8,' ',0800H,2,0,.SUBMODE$STEP$SW$ENABLE);
```

```
                $EJECT
                /* UTM SPHEROID SELECTION */
42   2            CALL CLEAR(0);
43   2            CALL DISPLAY$ACTIVE$WAYPT;
44   2            CALL DISPLAY(.SPHEROID$TABLEAU);
45   2            CALL DISPLAY$WAYPT$TYPE(WAYPT$TYPE);
46   2            CALL GRID(.SUBMODE$GRID);
47   2            CALL READ(.SPHEROID$ICB);
48   2            IF SW = SUBMODE$SW THEN RETURN(0);
50   2            IF SW = STEP$SW THEN RETURN(40H);
52   2            WAYPT.UTM$SPHEROID = SW$INDEX;
                /* UTM ZONE ENTRY */
53   2            CALL UPDATE$LINE(0, 4, 3, .SPHEROID$TEXT(WAYPT.UTM$SPHEROID));
54   2            CALL CLEAR(1);
55   2            CALL DISPLAY(.ZONE$TABLEAU);
56   2            CALL DISPLAY$WAYPT$TYPE(WAYPT$TYPE);
57   2            CALL DISPLAY$DIGIT$KB;
58   2         A:
                  CALL READ(.ZONE$ICB);
59   2            IF SW = SUBMODE$SW THEN RETURN(0);
61   2            IF SW = STEP$SW THEN RETURN(40H);
63   2            IF DATA$ENTERED AND (SW = ENTER$SW) THEN DO;
65   3              WAYPT.UTM$ZONE(0) = IN$BUF(0);
66   3              WAYPT.UTM$ZONE(1) = IN$BUF(1);
67   3              END;
68   2            ELSE GO TO A;   /* REJECT <ENTER> NOT PRECEEDED BY DATA */
                /* UTM ALPHA ENTRY */
69   2            CALL CLEAR(1);
70   2            CALL UPDATE$LINE(0,7,2,.IN$BUF);    /* PUT ZONE ON THE SCREEN */
71   2            CALL GRID(.ALPHA$KB$GRID);
72   2            CALL DISPLAY(.ALPHA$KB$TABLEAU);
73   2         B:
                  CALL READ(.ALPHA$ICB);
74   2            IF SW = SUBMODE$SW THEN RETURN(0);
76   2            IF SW = STEP$SW THEN RETURN(40H);
78   2            IF DATA$ENTERED AND (SW = ENTER$SW) THEN
79   2              CALL MOVE(3,.IN$BUF,.WAYPT.UTM$ALPHA);
80   2            ELSE GO TO B;
                /* UTM VALUE ENTRY */
81   2            CALL UPDATE$LINE(0, 9, 3, .IN$BUF);
82   2            CALL CLEAR(1);
83   2            CALL DISPLAY$DIGIT$KB;
84   2            CALL DISPLAY(.VALUE$TABLEAU);
85   2            CALL DISPLAY$WAYPT$TYPE(WAYPT$TYPE);
86   2         C:
                  CALL READ(.VALUE$ICB);
87   2            IF SW = SUBMODE$SW THEN RETURN(0);
89   2            IF SW = STEP$SW THEN RETURN(40H);
91   2            IF DATA$ENTERED AND (SW = ENTER$SW) THEN DO;
93   3              CALL MOVE(3,.IN$BUF,.WAYPT.UTM$VALUE);
94   3              WAYPT.STATUS = WAYPT.STATUS OR 2;
95   3              END;
96   2            ELSE GO TO C;
97   2            RETURN(1);  /* NORMAL RETURN - DATA ENTERED */

98   2         END;   /* OF UTM$DATA$ENTRY */
```

```
                $EJECT
 99   1         DECLARE(I,J,W) BYTE;

100   1         PACK$WAYPT: PROCEDURE(COUNT,SOURCE$PTR,DEST$PTR) PUBLIC;
                /* THE DATA FROM THE SOURCE ARRAY ARE SEPARATED INTO NIBLES AND ARE PLACED IN
                   SUCCESSIVE BYTES IN THE DESTINATION ARRAY IN THE LEFTMOST FOUR BITS.
                   THIS DATA WILL OVERLAY GRAPHICS DATA IN RMBUFB. */
101   2         DECLARE COUNT BYTE,    /* NUMBER OF BYTES TO BE PACKED */
                   SOURCE$PTR ADDRESS,
                   DEST$PTR ADDRESS;
102   2         DECLARE (SOURCE BASED SOURCE$PTR)(1) BYTE,
                   (DEST BASED DEST$PTR)(1) BYTE;

103   2            J = 0;
104   2            COUNT = COUNT - 1;
105   2            DO I = 0 TO COUNT;
106   3              W = SOURCE(I);
107   3              DEST(J) = (DEST(J) AND 0FH) OR (W AND 0F0H);
108   3              DEST(J+1) = (DEST(J+1) AND 0FH) OR SHL(W,4);
109   3              J = J + 2;
110   3              END;
111   2         END;   /* OF PACK$WAYPT */

112   1         UNPACK$WAYPT: PROCEDURE(COUNT,SOURCE$PTR,DEST$PTR) PUBLIC;
                /* THE LEFTMOST 4-BIT NIBBLES FROM THE SOURCE ARRAY ARE ASSEMBLED INTO BYTES
                   IN THE DESTINATION ARRAY. THE FIRST NIBBLE IS PLACED IN THE LEFT 4 BITS
                   OF THE FIRST BYTE. */
113   2         DECLARE COUNT BYTE,    /* NUMBER OF BYTES TO BE RETRIEVED */
                   SOURCE$PTR ADDRESS,
                   DEST$PTR ADDRESS;
114   2         DECLARE (SOURCE BASED SOURCE$PTR)(1) BYTE,
                   (DEST BASED DEST$PTR)(1) BYTE;

115   2            J = 0;
116   2            COUNT = COUNT - 1;
117   2            DO I = 0 TO COUNT;
118   3              DEST(I) = (SOURCE(J) AND 0F0H) OR SHR(SOURCE(J+1),4);
119   3              J = J + 2;
120   3              END;

121   2         END;   /* OF UNPACK$WAYPT */


122   1         END;   /* OF DNV5: DO; */



MODULE INFORMATION:

     CODE AREA SIZE     = 040BH   1035D
     VARIABLE AREA SIZE = 0010H     16D
     MAXIMUM STACK SIZE = 0006H      6D
     264 LINES READ
     0 PROGRAM ERROR(S)

END OF PL/M-80 COMPILATION
```

```
ISIS-II PL/M-80 V3.1 COMPILATION OF MODULE DAT
OBJECT MODULE PLACED IN :F1:DNVDAT.OBJ
COMPILER INVOKED BY:  PLM80 :F1:DNVDAT.SRC DATE(20OCT79) DEBUG


           $TITLE('DNVDAT')
  1         DAT: DO;
  2  1      DECLARE RMBUFA(1536) BYTE PUBLIC,
              RMBUFB(1536) BYTE PUBLIC;

  3  1      DECLARE    /* DNV VARIABLES */
              DNV$DESTINATION BYTE PUBLIC,
              DNV$DISPLAY$COORD$MODE BYTE PUBLIC,
             /* DNV INITIALIZATION REQUIRES THE FOLLOWING ITEMS BE CONTIGUOUS */
              DNV$WIND$SPEED(3) BYTE PUBLIC,
              DNV$WIND$DIR(2) BYTE PUBLIC,
              DNV$GROUND$SPEED(3) BYTE PUBLIC,
              DNV$RANGE(4) BYTE PUBLIC,
              DNV$TRACK$ANGLE$ERROR(3) BYTE PUBLIC,
              DNV$TRACK$ANGLE(3) BYTE PUBLIC,
              DNV$CROSS$TRACK$ANGLE(3) BYTE PUBLIC,
              DNV$BEARING(3) BYTE PUBLIC,
              DNV$TIME$TO$GO(3) BYTE PUBLIC,
             /****/
              DNV$STATUS BYTE PUBLIC,
              DNV$LAST$WAYPT$PTR ADDRESS PUBLIC,
              DNV$TEMP$WAYPT(34) BYTE PUBLIC,
              DNV$CKPT$DATA(10) STRUCTURE(DIGITS(68) BYTE) PUBLIC AT(.RMBUFB),
              DNV$TGT$DATA(10) STRUCTURE(DIGITS(68) BYTE) PUBLIC AT(.RMBUFB+680);
  4  1      END;   /* DAT */


MODULE INFORMATION:

    CODE AREA SIZE     = 0000H     0D
    VARIABLE AREA SIZE = 0C42H  3138D
    MAXIMUM STACK SIZE = 0000H     0D
    25 LINES READ
    0 PROGRAM ERROR(S)

END OF PL/M-80 COMPILATION
```

APPENDIX TASK REPORT

Results of "State of Art" Review

Function Flow and Allocations

Description of Alternate Designs

Description of Proposed Final Approach

RESULTS OF THE

STATE OF THE ART REVIEW

TECHNICAL APPROACH

APPROACH PREDICTED ON TECHNICAL INTENT OF PROJECT

CONSTRAINTS ON DESIGN APPROACH

EXCLUSIVE USE OF PROCESSOR TECHNOLOGY

GENERALIZE APPROACH — BUILDING BLOCKS

CONCEPTUAL DESIGN

MEMORY MAP

APPROACH PREDICTED ON TECHNICAL INTENT OF PROJECT

TECHNICAL INTENT OF PROJECT

- DEMONSTRATE THAT SIX COCKPIT DEVICES MAY BE REPLACED BY ONE

REASONS

- REDUCE THE NUMBER OF DEVICES PILOT MUST MAINTAIN WITHIN HIS COGNIZANCE
- SIMPLIFY OPERATING PROCEDURES
- ALLOW SUMMARY DISPLAY OF ENTIRE SYSTEM STATUS
- OPTIMIZATION OF COCKPIT REAL ESTATE

CONSTRAINTS ON DESIGN APPROACH

EXISTING BUILDING BLOCKS

- THE 48 x 96 LED MODULES
- MEMBRANE SWITCH
- DUAL IN LINE PACKAGES FOR ELECTRONIC DEVICES

CDU VOLUME ALLOWANCE

EASE OF MODIFICATION

- FUNCTION
- CONFIGURATION

EXCLUSIVE USE OF PROCESSOR TECHNOLOGY

FIRMWARE BASED SYSTEM ALLOWING FUNCTIONAL RECONFIGURATION WITH NO IMPACT TO HARDWARE

ALORITHMIC RATHER THAN LOGIC BASED

- LOOK UP TABLE RATHER THAN SYMBOL GENERATION
- ALGORITHM RATHER THAN LINE GENERATOR
- DISPLAY BUFFER WITH DIRECT MEMORY ACCESS RATHER THAN ON-THE-FLY DISPLAY GENERATION

POSSIBLE FUTURE USE OF COMPUTER CHIPS TO REPLACE CPU AND SUPPORTING CHIPS

GENERALIZED APPROACH — A GROUP OF BUILDING BLOCKS

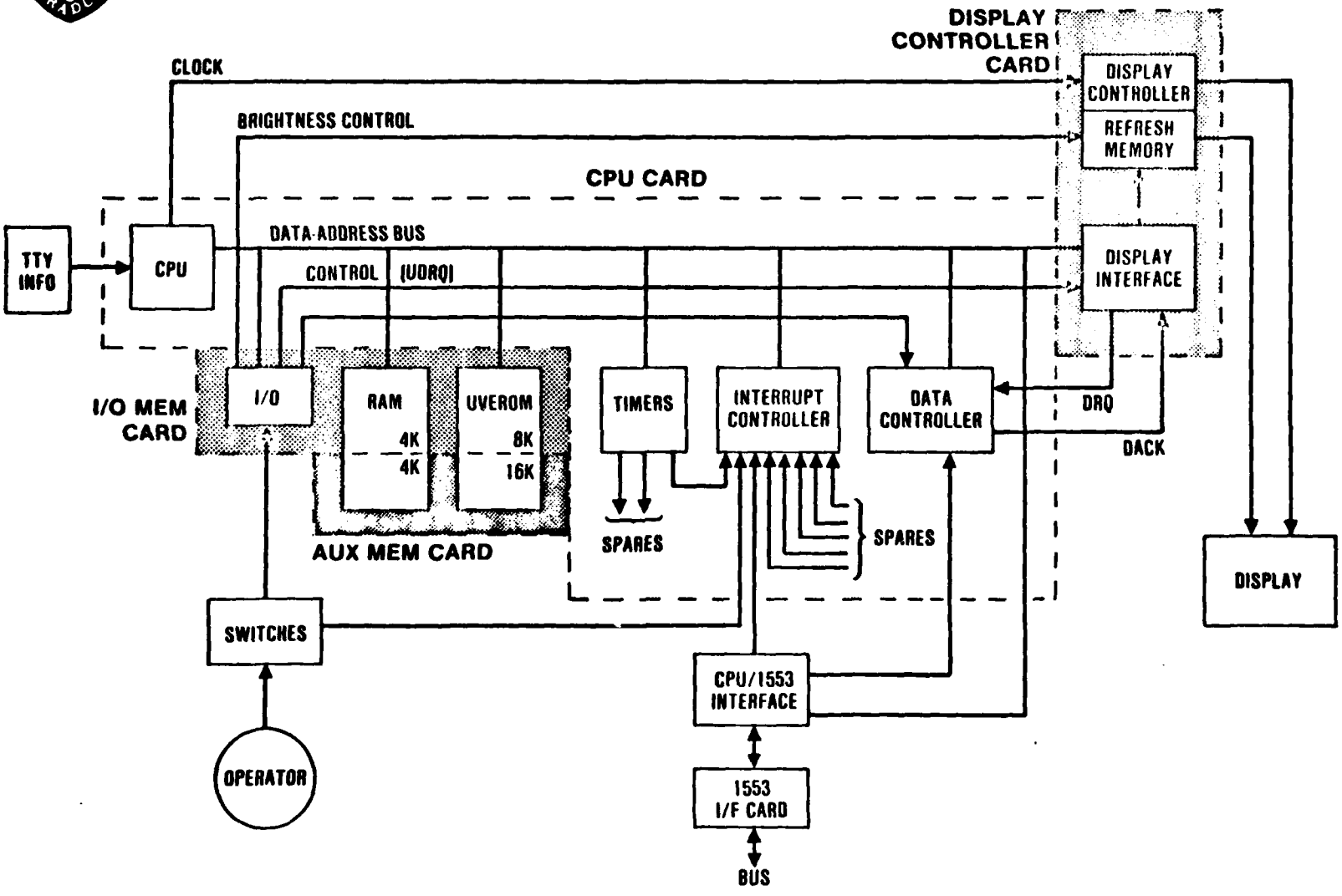
FRONT PANEL MAY TAKE ON ANY FORM

- MAXIMUM 64 SWITCHES
- THREE 48 x 96 LED MODULES
- ALL SWITCHES ARE LOGIC ACTIVATED

SWITCHES MAY TAKE ANY MEANING (SW ASSY CHANGEABLE)

MEMORY EXPANDABLE FROM 12K TO 32K

CONCEPTUAL DESIGN



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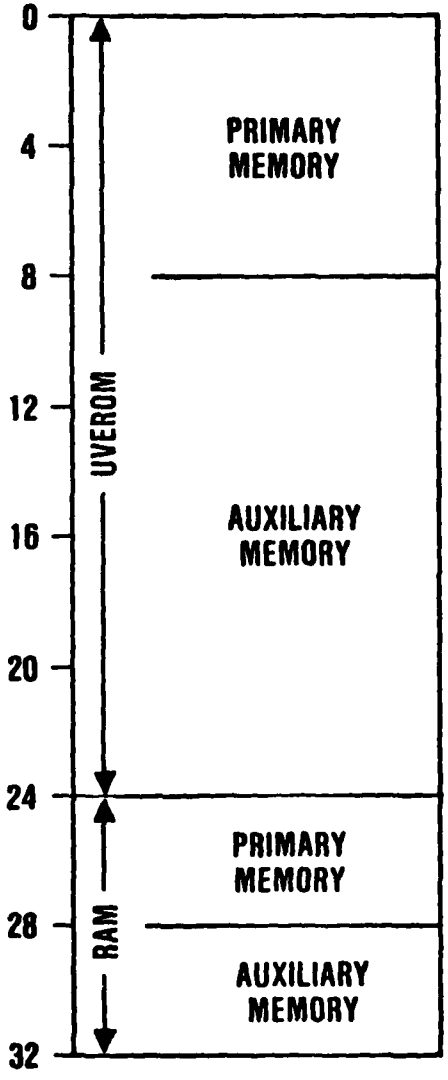
MEMORY MAP

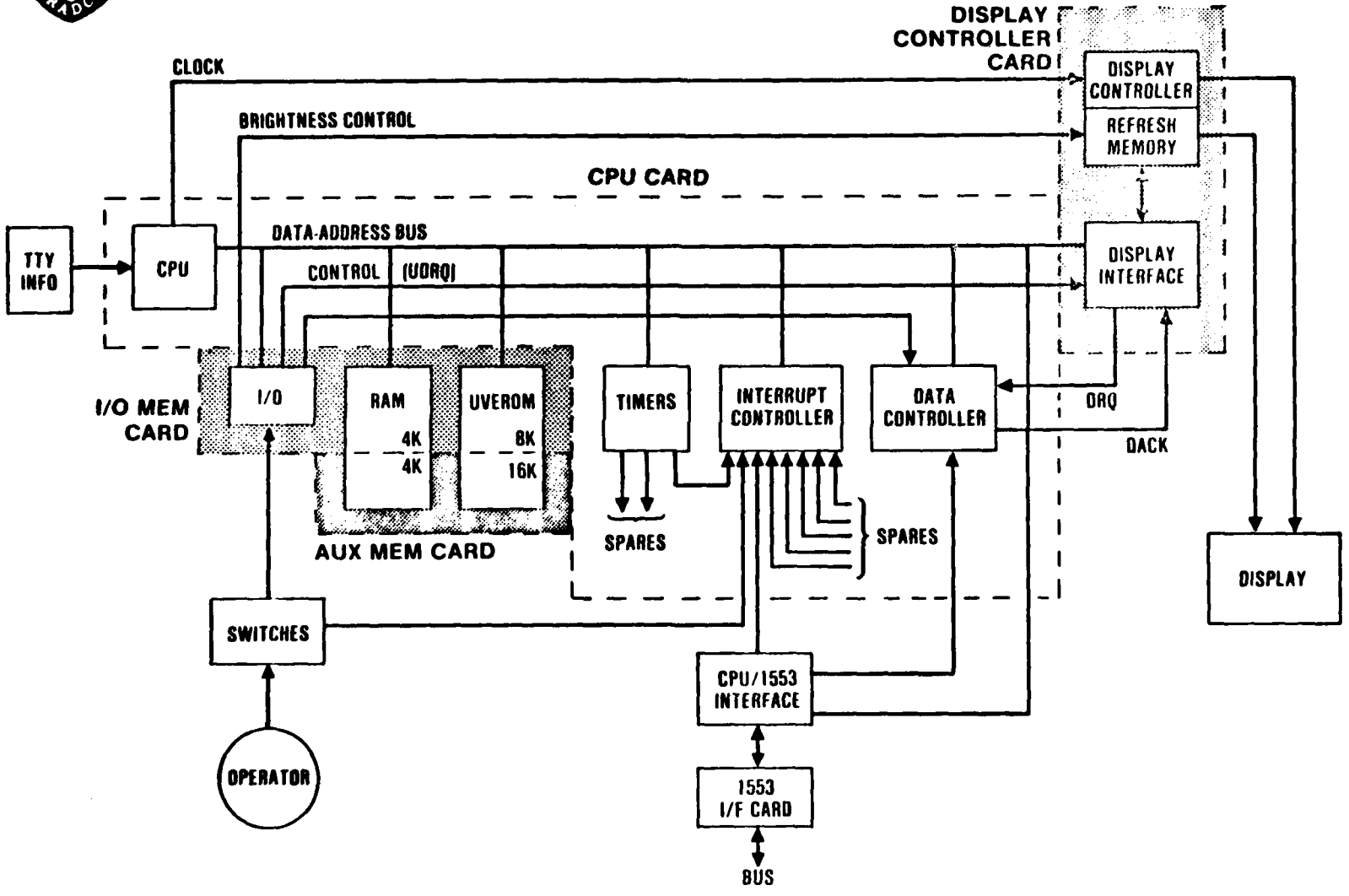
MEMORY ADDRESS AND CAPACITY



CDU FUNCTIONAL FLOW

AND ALLOCATION

CDU FUNCTIONAL FLOW AND ALLOCATION



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DESCRIPTION OF

ALTERNATE DESIGNS

DESCRIPTION OF ALTERNATE DESIGNS

The culmination of current State of Art investigations and incorporation of the resultant technologies has determined the present Design philosophy. Alternate designs have, however, been anticipated in the implementation of certain control functions. These are:

1. Power Control
2. Manual/Automatic Display Brightness Control
3. Display Response Control

The Area of Power Control was not fully designed to an end item configuration due to the requirement for the Control Display Unit to be operational in a portable configuration and utilizing Standard 110V AC as a power source. It is, therefore, anticipated that power control implementation studies should be completed to determine Mechanical/logic implementation from a system view.

Bright/Dim control is an area that, for suitcase demonstrations, was implemented in a straight-forward manner, that is, the use of an octal coded thumbwheel switch. Studies must be completed to determine light control requirements for cockpit displays so that appropriate control policies may be implemented into future designs..

Display response is less than optimized due to the implementation limitations of Design funding, program implementation time constraints, and customer definition. Therefore, there is left two other optimization avenues that should be considered for final Design. These are: Restructuring of the Display orientation and redesign of existing module design, to adapt the presently used module for this specific application.

DESCRIPTION OF PROPOSED FINAL APPROACH

The requirements identified at this time that will allow transition from a suitcase demonstration unit into an Advanced Engineering Development model are as follows:

A. Studies
   - Human Factors
   - System Integration
   - Program Loading
   - System Redundancy
   - Test Equipment
   - Design to Unit Production Cost Goal
   - Power Control Implementation
   - Display Brightness Control (where, how)

B. Design
   - Appropriate 1553 Interface
   - ADM Electro/Mechanical Implementation

C. Fabrication
   - Two Units (ADM)

D. Testing
   - Electrical Verification - 1 Unit
   - Electro/Mechanical - 1 Unit

AN-MTI-001 A

APPLICATION NOTE
FOR
MULTIPLEX TERMINAL UNIT
(MTI-110)

SCI PART NO. 4199000-1

APRIL 1976

Revised February 1977

SCI SYSTEMS, INC.
8600 SOUTH MEMORIAL PARKWAY
HUNTSVILLE, ALABAMA 35802

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LIST OF FIGURES

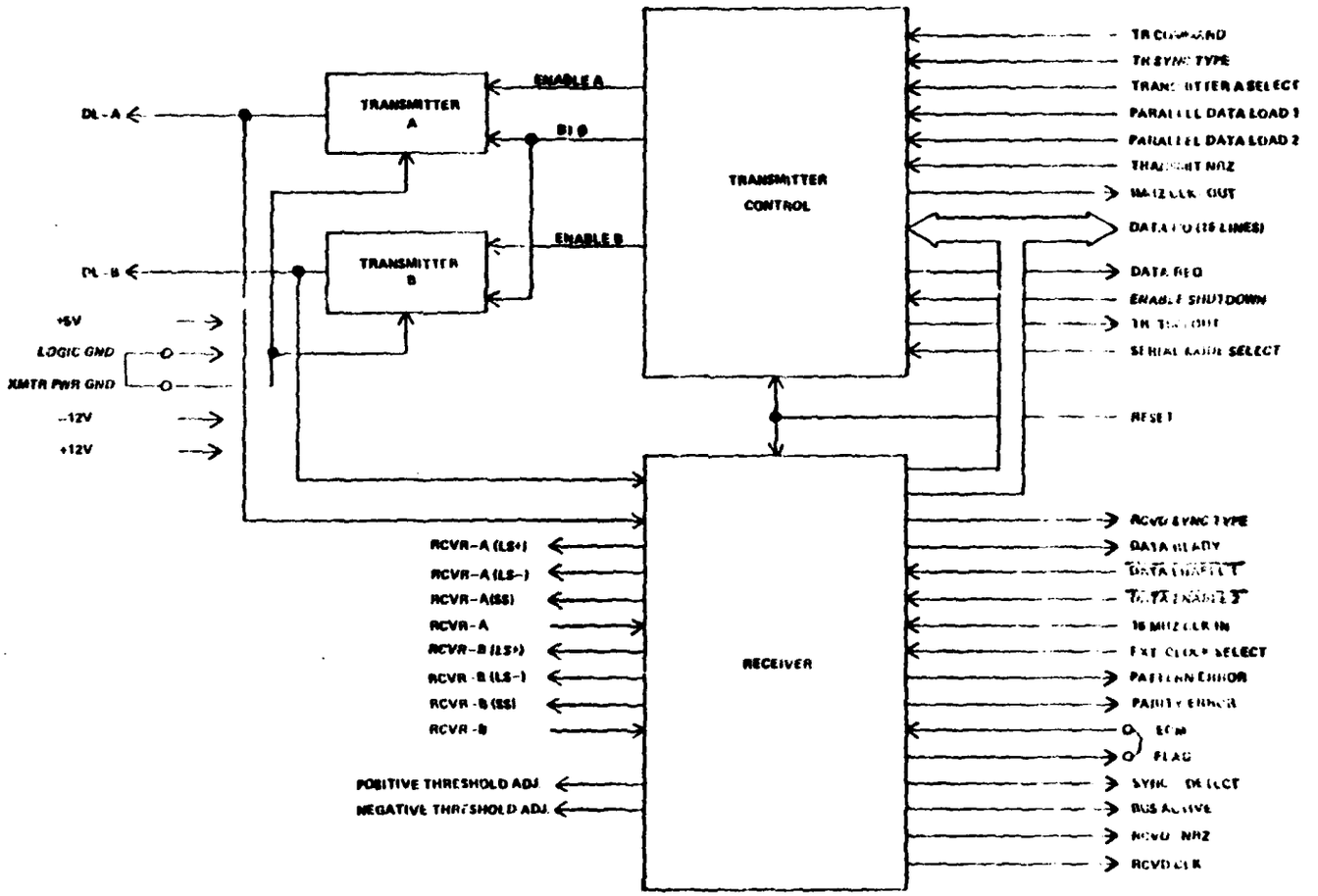
1.0 GENERAL DISCRIPTION

The MTI-110 is a multiplex data bus interface module designed for aircraft subsystems signal transfer. It provides a two way interface between TTL logic and dual redundant twisted pair transmission lines utilizing serial bi-phase data transmission as specified by MIL-STD-1553A and MIL-G-85013. The MTI is capable of operating on either of the two redundant busses on command of the user. A block diagram of the MTI-110 is shown in Figure 1. Data appearing on the data bus is received by the MTI-110 and presented both in serial and in parallel form along with control signals and data validity signals. The receiver parallel output is available as 3-state outputs and can be enabled in 2 - 8 bit bytes or 1 - 16 bit word. The receiver is operated from a 16 MHz clock which is available internally or may be provided externally by the user.

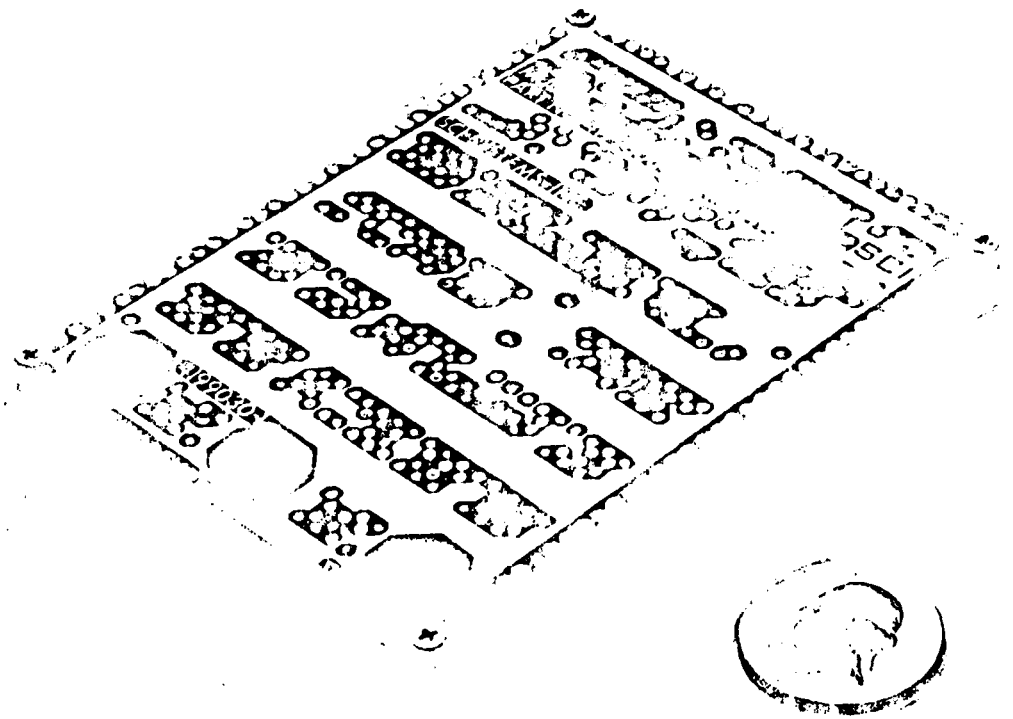
Data to be transmitted on the data bus is accepted by the MTI-110 either in serial or in parallel form and may be transmitted on either of 2 data busses. Although the MTI-110 is designed specifically to meet MIL-STD-1553A which calls for a 16 bit data word plus parity, it can operate in the serial mode with any word length as long as each word begins with a MIL-STD-1553A sync pattern and ends with a parity bit.

1.1 MECHANICAL DESCRIPTION

The complete MTI-110 module is shown in Plate M954. It consists of two multilayer printed circuit boards held together as a module by the use of screws and spacers. All inter-board connections are by spring-type pin connectors as shown in the disassembled view (Plate M956). Standard flat pack type integrated circuits are used throughout. There are no custom hybrid, LSI or other custom circuits. User connections are by the use of 62 pins arranged in a dual in line pattern. The complete module measures 3 x 4 x 0.375 and weighs 3.5 oz. Mechanical details are shown in Drawing AN-MTI-001.

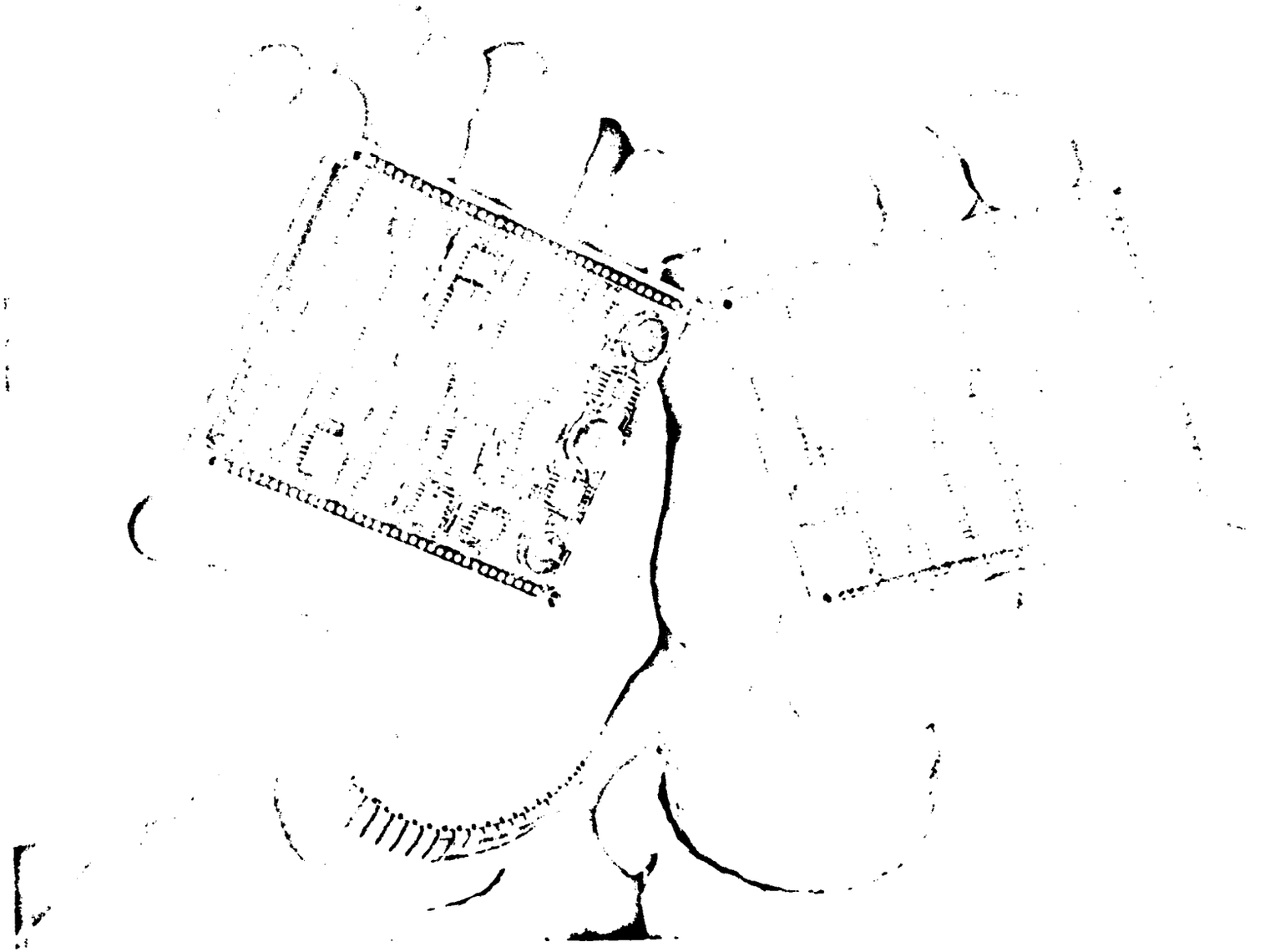


MTI-110 BLOCK DIAGRAM
FIGURE 1



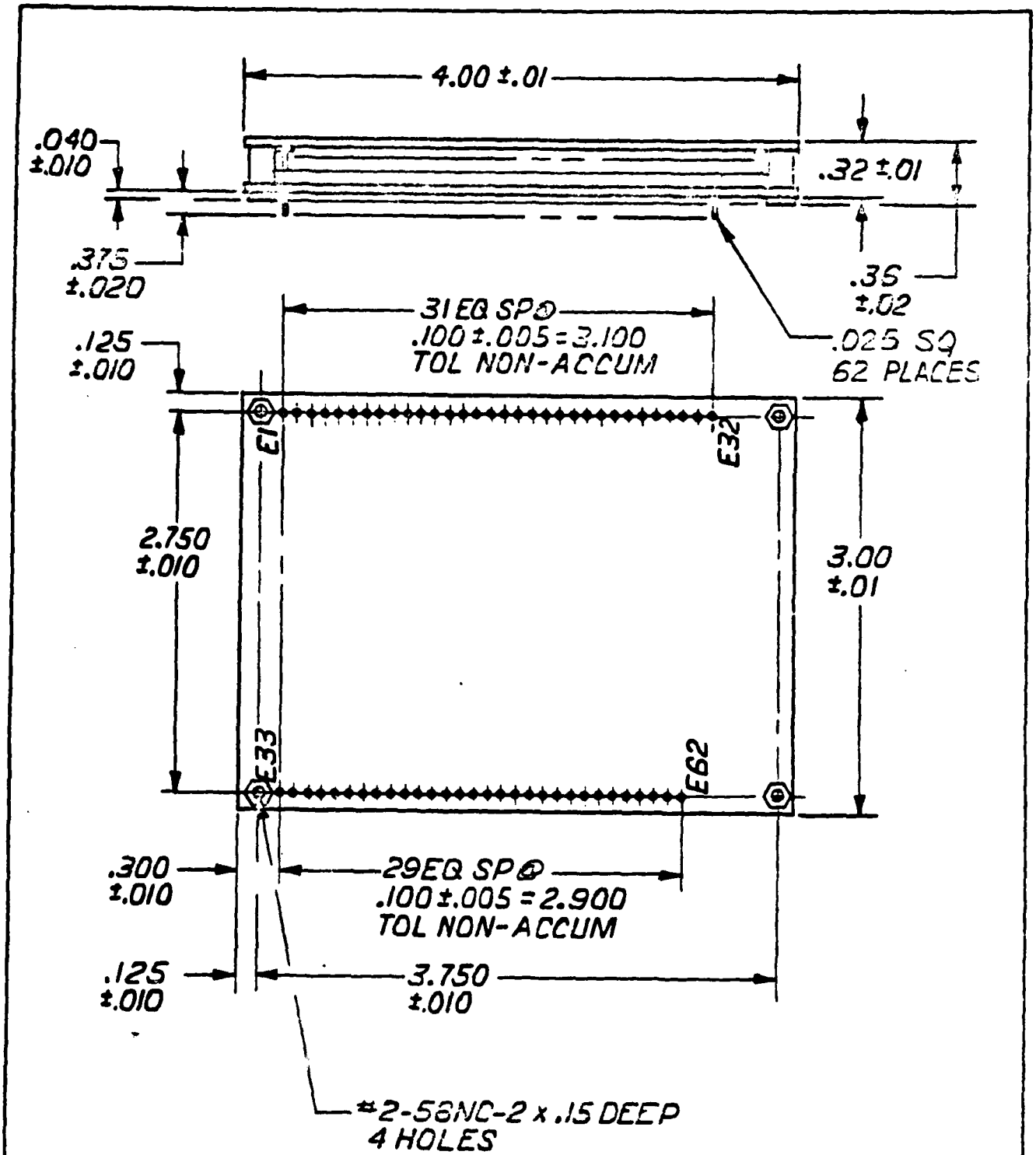
MULTIPLEX TERMINAL UNIT MTI – 110

M954



MTI – 110 MULTIPLEX TERMINAL UNIT (DISASSEMBLED)

M956



CODE IDENT. NO. 17981	DWG. SIZE A	AN-MTI-001	
		OF	REV

SCI FORM NO. 810-062 (REV. 11/71)

1.2 TIMING DIAGRAMS

Detailed relationships among the various interface signals involved in I/O operations are shown in the timing diagrams of Figures 2 and 3. In these diagrams each signal or group of signals is represented by a horizontal line with a raised section. In the case of a control signal that is generated at a specific time to control some particular function, the raised section represents the time that the function is true. For signals that carry binary information such as the data I/O line and the sync type lines, the raised section indicates the time during which that information is held on the input or output line.

1.3 INPUTS AND OUTPUTS

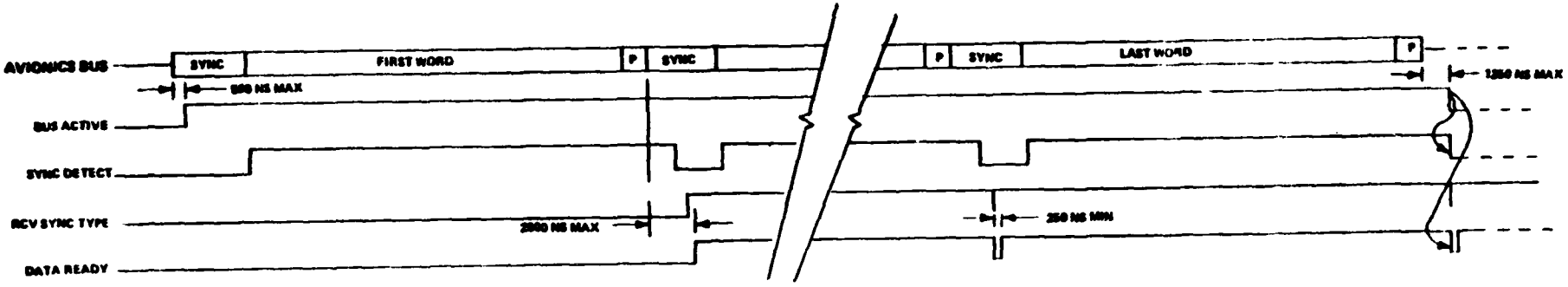
All MTI-110 inputs and outputs are shown in the pin function list (Table I). All inputs and outputs are standard TTL compatible except for those given in Table II. TTL outputs will drive two standard TTL loads minimum and inputs are equivalent to one low power Schottky TTL load, except for the external clock input which is equivalent to 10 low power Schottky TTL loads.

1.4 POWER REQUIREMENTS

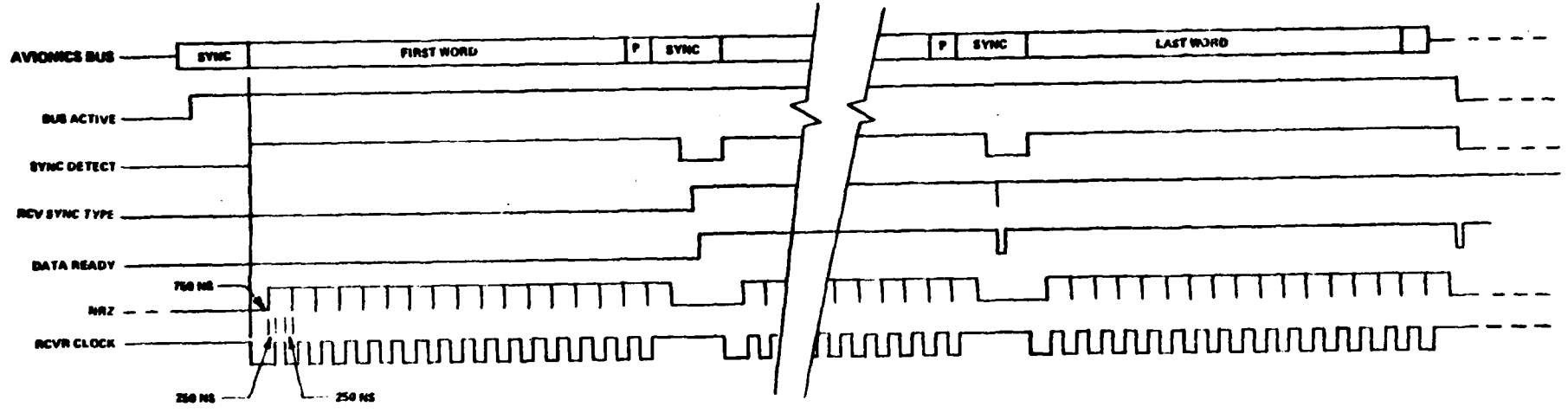
The MTI-110 requires three supply voltages: +5 volts, +12 volts and -12 volts. While the MTI-110 will operate with up to $\pm$15 volts, all current drain and signal threshold specifications are based on the use of a $\pm$12 volt supply. Current requirements are as follows:

+5 Volts		600 ma max
+12 Volts	(non-transmitting)	30 ma max
	(transmitting - long stub)	650 ma max
	(transmitting - short stub)	300 ma max
-12 Volts		30 ma max

Voltage tolerance is $\pm$5%.

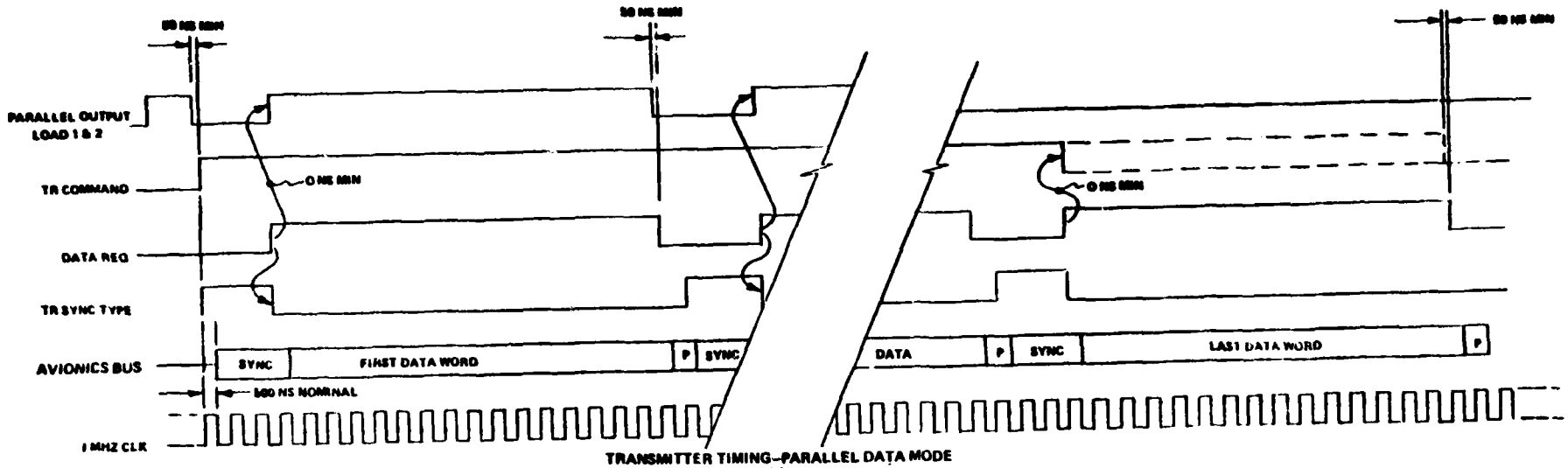


RECEIVED DATA – PARALLEL MODE

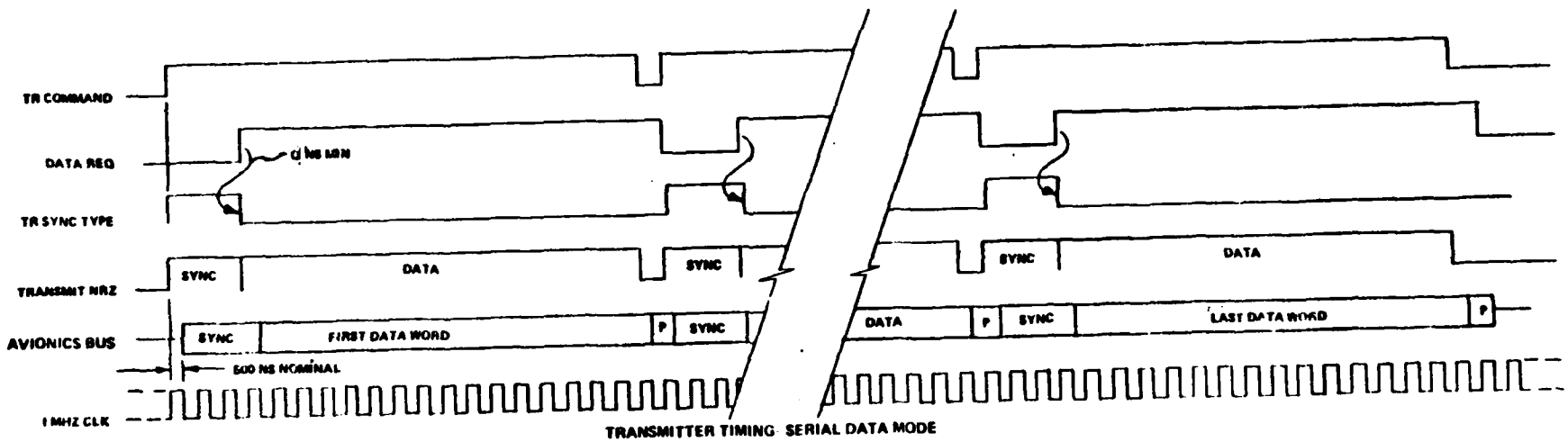


RECEIVED DATA – SERIAL MODE

RECEIVED DATA TIMING
FIGURE 2



TRANSMITTER TIMING–PARALLEL DATA MODE



TRANSMITTER TIMING–SERIAL DATA MODE

TRANSMITTED DATA TIMING
FIGURE 3

TABLE I

MTI 110 PIN FUNCTION LIST

Terminal	Function	Terminal	Function
1	data link B (+)	32	+5 volts input
2	data link B (-)	33	data link A (+)
3	receiver input B (LS+)	34	data link A (-)
4	receiver input B (SS)	35	receiver input A (LS+)
5	data I/O 0 (LSB)	36	receiver input A (SS)
6	data I/O 4	37	data I/O 15(MSB)
7	data I/O 2	38	transmitter power ground
8	data I/O 5	39	data I/O 13
9	data I/O 3	40	transmitter timeout
10	transmitter A select	41	data I/O 10
11	data I/O 1	42	data I/O 8
12	+12 volts input	43	data I/O 11
13	data I/O 6	44	data I/O 9
14	1 MHz clock output	45	data I/O 14
15	data I/O 7	46	flag output
16	external clock input	47	data I/O 12
17	parallel data load 1	48	parallel data load 2
18	external clock select	49	data enable 2
19	-12 volts input	50	parity error output
20	negative threshold adjust	51	pattern error output
21	data enable 1	52	enable shutdown input
22	receiver input B	53	received NRZ output
23	serial mode select	54	data ready output
24	receiver input A	55	received clock output
25	reset input	56	bus active output
26	transmit command input	57	sync detect output
27	transmit NRZ input	58	receiver input A (LS-)
28	data request output	59	received sync type output
29	receiver input B (LS-)	60	end of message (EOM) input
30	positive threshold adjust	61	----------
31	transmit sync type input	62	logic ground

TABLE II

MTI-110 NON-TTL PIN FUNCTIONS

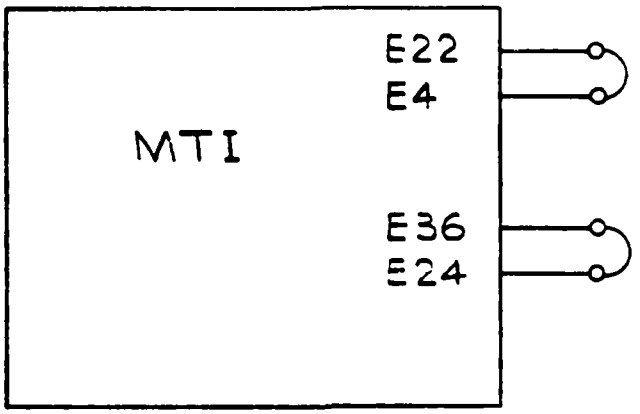
Function	Pin Number
data link B (+)	1
data link B (-)	2
receiver input B (LS+)	3
receiver input B (SS)	4
+12 volts input	12
-12 volts input	19
negative threshold adjust	20
receiver input B	22
receiver input A	24
receiver input B (LS-)	29
positive threshold adjust	30
+5 volts input	32
data link A (+)	33
data link A (-)	34
receiver input A (LS+)	35
receiver input A (SS)	36
transmitter power ground	38
receiver input A (LS-)	58
logic ground	62

2.0 DATA LINK INTERFACE

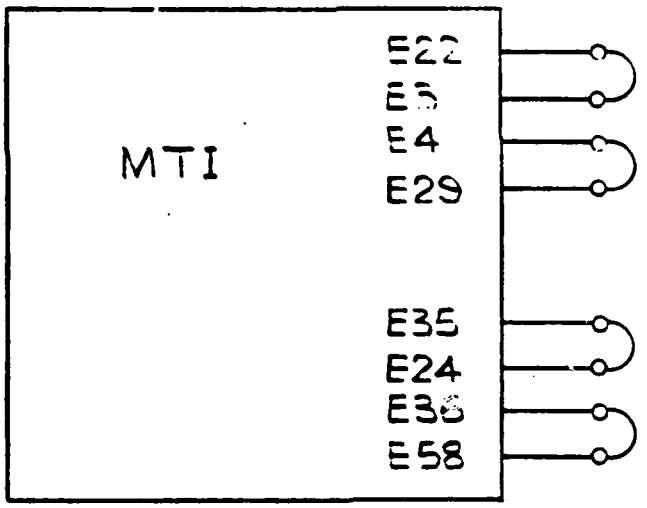
The MTI-110 includes provisions for two MIL-STD-1553A data links. Either or both data links may be connected. Data may appear on only one data link at a time. If only one data link is used the other must be terminated with 70 ohms maximum. The MTI is designed for use in either the long stub or short stub configuration as described by MIL-STD-1553A. In either configuration external jumpers must be used to connect the receiver input as shown in Figure 4.

Figure 5 shows the MTI-110 receiver input transformer with external strapping options and stub configurations shown. The receiver A input is shown in the short stub configuration and receiver B is connected for long stub operation. The two receiver input circuits are identical and may be strapped independently for either configuration. There are three windings on the MTI-110 coupling transformer which are associated with the receiver input. Winding 1 is the input from the data link and windings 2 and 3 provide the input to the receiver. For MIL-STD-1553A short stub operation, winding 3 provides the receiver input and winding 2 is unused as shown in Figure 5A. External isolation resistors must be used as shown.

For long stub operation, windings 2 and 3 are connected in series as shown in Figure 5B and a MIL-STD-1553A data link coupler must be used between the bus and the stub. The data link coupler (SCI Model DLC-10 or equivalent) contains the isolation transformer and proper isolation resistors to meet all the requirements of MIL-STD-1553A for long stub operation. If a different coupling transformer is used, the source impedance of the coupler as it is connected to the MTI must be 50 ohms minimum or overloading of the MTI transmitter will result.



SHORT STUB OPERATION OR LONG STUB WITH 1:1 COUPLING TRANSFORMER.



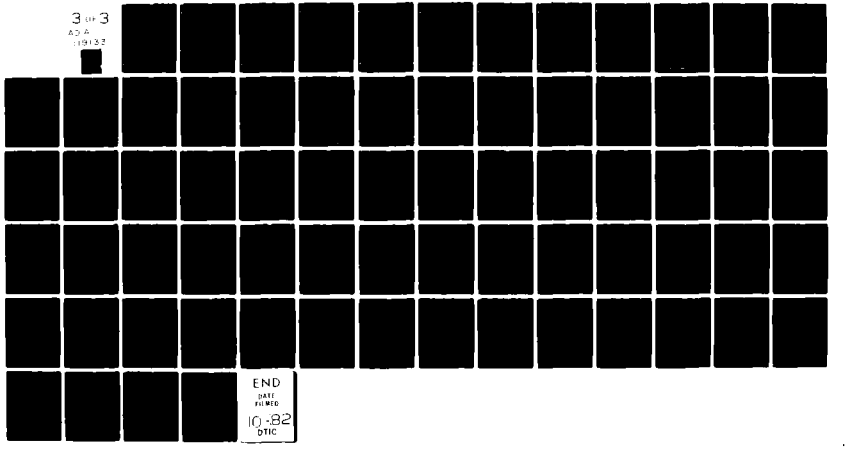
LONG STUB OPERATION WITH 3:1 COUPLING TRANSFORMER.

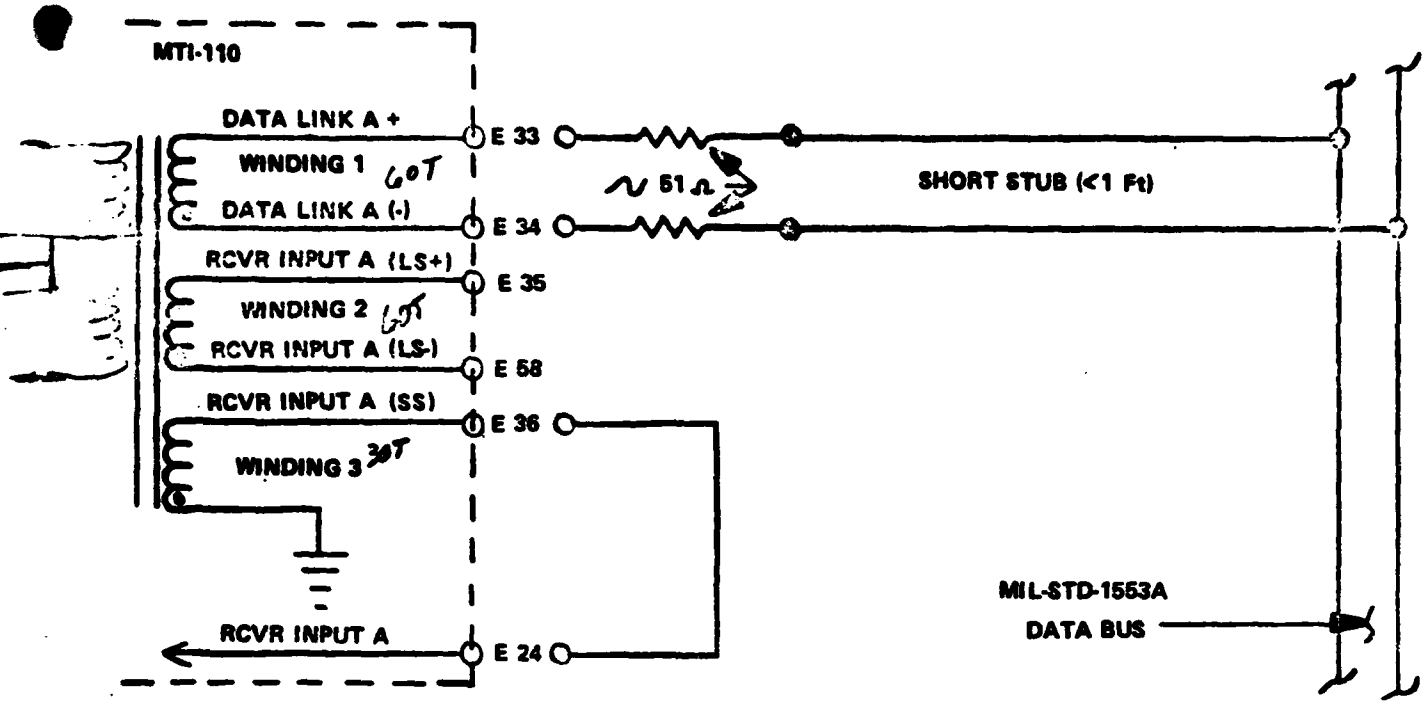
FIGURE 4. RECEIVER INPUT EXTERNAL STRAPPING OPTION

CODE IDENT NO	DWG SIZE
17881	A

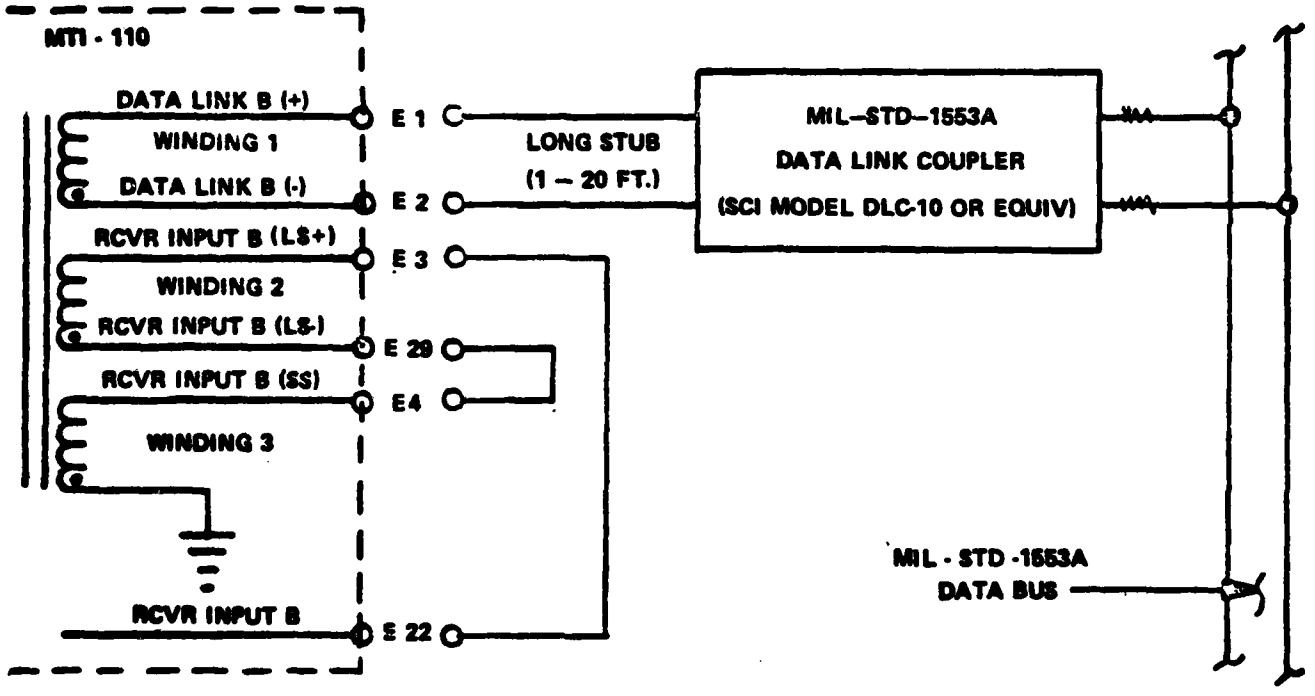
AD-A119 133 LITTON SYSTEMS INC VAN NUYS CALIF DATA SYSTEMS DIV F/G 9/2
CONTROL DISPLAY UNIT PROGRAM.(U)
1978

UNCLASSIFIED NL





A. SHORT STUB CONFIGURATION (RECEIVER INPUT A SHOWN)



B. LONG STUB CONFIGURATION (RECEIVER INPUT B SHOWN)

FIGURE 5. MTI – 110 RECEIVER INPUT TRANSFORMER CONNECTIONS

3.0 RECEIVER OPERATION

The MTI-110 features an all-digital biphase receiver design which provides high stability without the requirement for special bench alignment. A complete description of user options and external connections pertaining to receiver operation is provided in this section.

3.1 EXTERNAL CLOCK (E16)

The MTI normally operates from an internal 16 MHZ clock but may be operated from an external 16 MHZ clock at the user's option. This is done by presenting a 16 MHZ TTL level clock to the external clock input (E16) and leaving the external clock select input (E18) open. For internal clock operation the external clock select input must be grounded.

3.2 RECEIVER THRESHOLD ADJUST (E20, E30)

The MTI receiver thresholds are factory set at +0.1V and -0.1V at the detector input, and these factory settings are compatible with MIL-STD-1553A. The threshold points are available for external adjustment and may be adjusted over the range of $\pm$0.075V to $\pm$0.2V by injecting a current into the threshold adjustment node. The input impedance of each node is 100 ohms.

3.3 RESET (E25)

A logic one on the reset input sets the receiver data ready to zero, turns off the transmitter and initializes the transmitter shutdown circuit. A logic one should be applied momentarily to the reset input when the MTI is being powered up in order to insure proper operation. The reset should remain high until power lines are stable. If the transmitter failsafe timer causes the transmitter to shut down, the reset must be reapplied before the transmitter is operated again. Minimum pulse width on the reset input is 100 nanoseconds.

3.4 DATA READY (E54)

Data ready goes high after a word has been received on the data link. Each time a new word is received on the data link the data ready line goes low for a period greater than 250 nanoseconds and less than one microsecond and then goes high again. Data ready remains high until a new word is received. Data, received sync type, pattern error, and parity error outputs may be read at any time while data ready is high.

3.5 RECEIVED SYNC TYPE (E59)

Received sync type indicates whether the received word was a command word or a data word. Received sync type is low for a command word and high for a data word. Received sync type may be read when data ready is high.

3.6 DATA ENABLES (E21, E49)

The 16 receiver output data lines are three-state. They are enabled in eight bit bytes by $\overline{\text{data enable 1}}$ and $\overline{\text{data enable 2}}$. $\overline{\text{Data enable 1}}$ enables the least significant byte and $\overline{\text{data enable 2}}$ enables the most significant byte. A low on the enable line enables the output lines. The propagation delay from enable to output is less than 100 nanoseconds.

3.7 PATTERN ERROR (E51)

The pattern error output is high if the received data word contains a Manchester coding violation or an invalid word length. A high output indicates an error. The pattern error output may be read when data ready is high.

3.8 PARITY ERROR (E50)

The parity error output is high if the received data word contains even parity and low for odd parity. The parity error output may be read when data ready is high.

3.9 FLAG AND EOM (E46, E60)

The flag output must be connected to the EOM input for normal MIL-STD-1553A operation. These signals may be used in conjunction with external circuitry to change the receiver word length for serial data output only. Figure 6 shows the external circuitry required to change the receiver word length. Parallel data and parity are available at the outputs of the flip-flops shown in the figure. These outputs are valid while the Q output of FF1 is high.

3.10 SYNC DETECT (E57)

The sync detect output goes high when a valid sync pattern is detected on the data link. The sync detect output goes low again when the first half of a sync pattern is detected or when the data link becomes inactive.

3.11 BUS ACTIVE (E56)

Bus active goes high 250 nanoseconds after a signal appears on the data link and goes low one microsecond after the data link goes inactive.

3.12 RECEIVED NRZ AND RECEIVED CLOCK (E53, E55)

The received NRZ output contains the serial NRZ data and parity. The received clock output is a 17 pulse clock output which is derived from the received biphase data. The NRZ data bits may be read on the rising edge of the received clock.

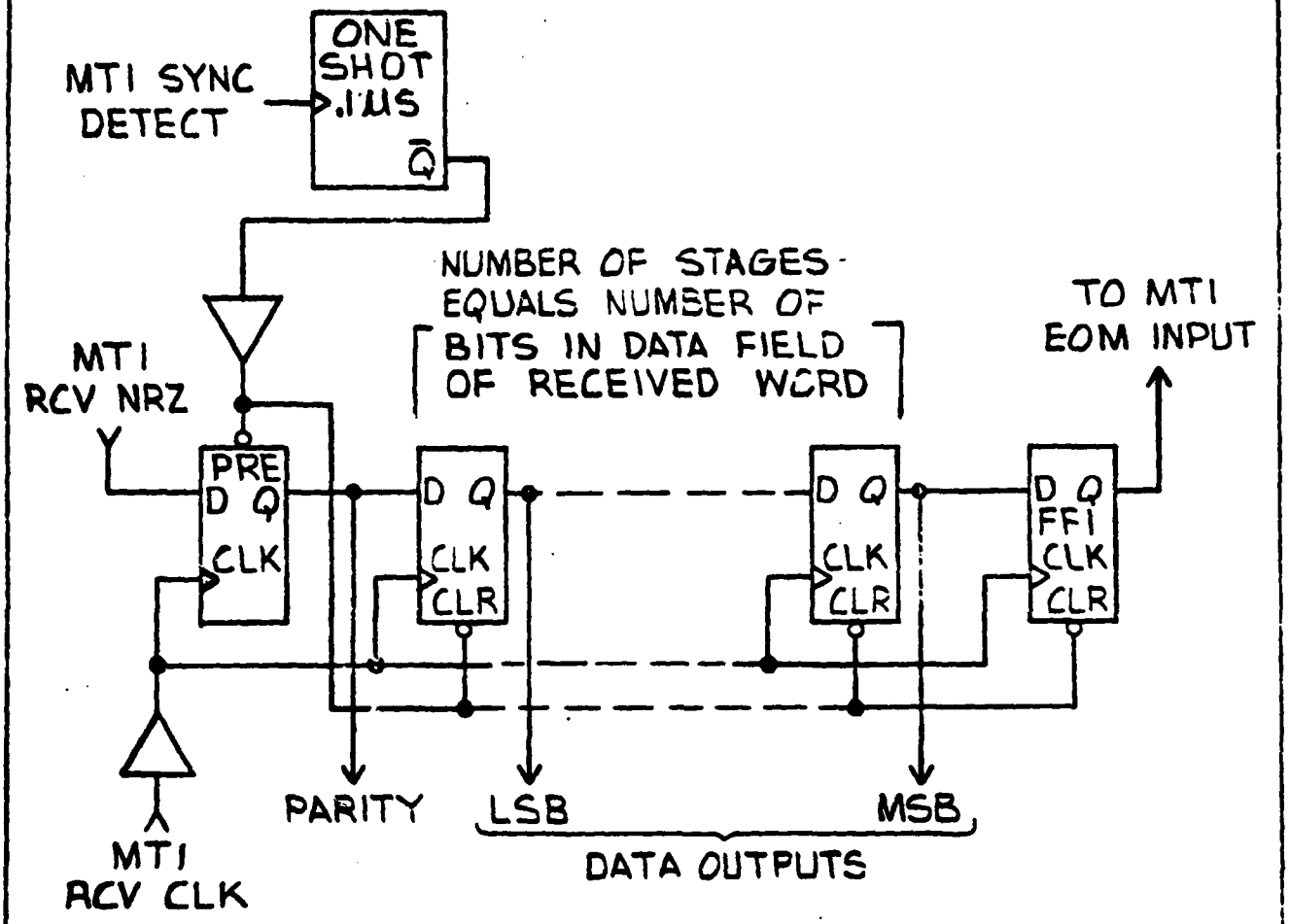


FIGURE 6. RECOMMENDED CIRCUIT FOR CHANGING RECEIVER SERIAL WORD LENGTH

CODE IDENT. NO. 17881	DWG. SIZE A		
		OF	REV

4.0 TRANSMITTER OPERATION

The MTI-110 transmitter allows operation on either of two MIL-STD-1553A data busses. Two complete transformer-coupled interfaces are provided, allowing the MTI to transmit on either bus at the command of the user. A complete description of user options and external connections pertaining to transmitter operation is provided in this section.

4.1 TRANSMITTER A SELECT (E10)

The MTI transmitter is capable of transmitting on either of two data links. When the transmitter A select input is high the data will be transmitted on data link A and when the transmitter A select input is low data will be transmitted on data link B.

4.2 ENABLE SHUTDOWN (E52)

The MTI incorporates a timer which times all transmissions. When the enable shutdown input is high the MTI transmitter will be shutdown automatically if the timer senses a transmission period exceeding 672 microseconds. A reset input must be applied in order to reset the shutdown circuit to allow subsequent transmissions to occur. If the enable shutdown input is low the timer will not shutdown the transmitter.

4.3 TRANSMITTER TIMEOUT (E40)

The transmitter timeout output is a positive pulse which occurs when the transmitter timer senses that the MTI has transmitted continuously for more than 672 microseconds. Minimum pulse width on this output is 100 nanoseconds.

4.4 SERIAL MODE SELECT (E23)

The MTI transmitter will accept data in either serial or parallel form. When the serial mode select input is high the MTI transmitter accepts serial NRZ data from the transmit NRZ input. When the serial mode select input is low the MTI transmitter accepts parallel data from the 16 data I/O lines.

4.5 TRANSMIT COMMAND (E26)

The MTI transmitter is turned on by the transmit command input. A high input turns the transmitter on and a low input turns the transmitter off. For proper operation the transmit command must go high within 0 to 300 nanoseconds after the rising edge of the MTI one megahertz clock output. The transmission begins on the falling edge of the one megahertz clock output. When the transmitter is operating in the parallel data input mode the TR command must remain high until the last word to be transmitted, then it must go low while the MTI data request output is high. The transmission will then be terminated at the end of the current word. When the transmitter is operating in the serial data input mode all transitions of the transmit command must occur within 0 to 300 nanoseconds after the rising edge of the MTI one megahertz clock output. The transmit command is required to go low during the last bit period (parity) of each word. During the last word to be transmitted the TR command goes low at the beginning of the last bit period and remains low. The word length of the transmitted message in the serial data input mode is determined by the transmit command input.

4.6 TRANSMIT SYNC TYPE (E31)

The transmit sync type input determines the polarity of the sync pattern of each word transmitted by the MTI. When the transmit sync type input is high a

command sync pattern will be generated and when it is low a data sync pattern will be generated. The sync type information must be present on the transmit sync type input during the time that the data request output is low.

4.7 PARALLEL DATA LOAD 1 AND 2 (E17, E48)

In the parallel data input mode the data present on the 16 I/O data lines is loaded into the MTI transmitter input register in 8 bit bytes by the parallel data load inputs. Data is loaded on the rising edge of each parallel load input. The data must be present 100 nanoseconds before the rising edge occurs and must remain until 10 nanoseconds after the edge occurs. Parallel data load 1 loads the least significant byte of data and parallel data load 2 loads the most significant byte of data. The first word of a message to be transmitted must be loaded before the transmit command goes high. All succeeding words are loaded during the time when the data request output is high. One word is loaded during each high interval of the data request output.

4.8 TRANSMIT NRZ (E27)

When the MTI transmitter is operating in the serial data input mode the serial data and parity to be transmitted must be present at the transmit NRZ input. The first bit of each data word to be transmitted is taken by the transmitter on the rising edge of the data request output. All succeeding bits of the word are taken on succeeding rising edges of the one megahertz clock output. Each bit of data to be transmitted must be present 100 nanoseconds before the edge on which it is taken and must remain for 10 nanoseconds after the edge occurs.

4.9 ONE MEGAHERTZ CLOCK (E 14)

The one megahertz clock output is provided for the user for input data and control input synchronization. Its use is explained in the appropriate paragraphs.

4.10 DATA REQUEST (E28)

All data must be loaded into the MTI transmitter when the data request is high. Use of the data request output is explained in more detail in the appropriate paragraphs.

1 August 1979

ATTACHMENT A

ENGINEERING DESIGN TEST PLAN

ECOM CDU DISPLAY AND CONTROL FORMATS

The final formats for the ECOM CDU are detailed in this document.

Primary Format

The Primary Format for the CDU is shown in Figure 1. This format is both a control and display format in that each piece of equipment displayed in this format can be selected for use by pressing the equipment designator (i.e., [VHF]) which is a switch point and will change the display from the Primary Format display to the Submode Display for the selected equipment.

The status of each piece of equipment will be shown by three methods. Equipments that have not reported a malfunction and are considered operable, will have the frequency they are tuned to displayed in line with the designator in the case of communications equipment and the mode they are in, in the case of DNV and IFF equipment.

If the equipment is active and in use, an asterisk will be displayed between the equipment designator and the frequency or mode as illustrated for the VHF, DNV and IFF in Figure I.

If the equipment is inoperative by failing its internal test or is not installed, a [FAIL] will be displayed in place of the frequency or mode as shown for ADF in Figure 1. 'NO KIT' will be displayed with the IFF, if a KIT is not installed or is faulty.

In all cases, selection of a radio or other unit, by pressing the equipment designator will display the Submode format for that equipment as follows:

Table I

Select	Display
VHF	Figure 2
UHF	Figure 3
ADF	Figure 4
CNV	Figure 5
DNV	Figure 6
IFF	Figure 7

Ten fixed switches will be provided below the display area of the CDU. These switches will have the following function:

[PRI] - Activation of this switch will return the display to the Primary Format, Figure 1.

[IFF EMER] - This switch is guarded and requires a sequence of operation to activate the function as follows: First, press [IFF EMER], then [GARD], and then [IFF EMER] again to select the IFF emergency function.

[ZERO CODE] - This switch is guarded and requires a sequence of operation to activate the function as follows: First, press [ZERO CODE], then [GARD], and then [ZERO CODE] again, to select this function.

[ON] - The ON switch is used to turn on the CDU and each equipment on as follows:

A. With the CDU in the OFF state, activation of [ON] will apply power to the CDU and display the Primary Format, Figure 1.

B. With the CDU on and the Primary Format displayed, activation of an equipment designator ([VHF] etc.) will display the Submode Format for the equipment as shown in Table 1. Activation of [ON] after activation of equipment designator will then turn the equipment on, with the exception of the IFF. The IFF is put into the [STBY] or [NORM] operation by selection of either respective switch.

[OFF] - The [OFF] switch is used to turn the CDU and each equipment off as follows: With the CDU on and the Primary Format displayed, selection of an equipment designator will display the equipment Submode Format shown in Table 1 and then selection of [OFF], will turn the equipment off. The displayed asterisk symbol (ON indicator) will be erased from the Primary Format. Each of the equipments, with the exception of the CDU and the IFF, will be turned off in this manner. The CDU and the IFF will be turned off, using the guarded switch function as follows:

A. <u>IFF OFF</u> - Select [IFF] from the Primary Format, (IFF Submode Format will display), activate [OFF], then [GARD], then [OFF]. This will turn the IFF subsystem off.

B. CDU OFF - With the Primary Format displayed, select [OFF], then [GARD], and then [OFF] again to turn the CDU off.

[SUB MODE] - Activation of [SUB MODE] will return the display to the Submode Format (Table 1), when a subset of the Submode is being displayed. Activation of [SUB MODE] when the Primary Format, or any Submode Format (Table 1) is displayed, will have no effect on the display or equipment.

[RPLY] - Activation of the [RPLY] switch will send a message to the IFF subsystem via the 1553A bus interface. It will have no effect on the display.

[GARD] - The [GARD] switch is used as described previously.

[LAST] - This switch is used in the communications formats and DNV formats. When activated with a VHF or UHF format displayed, it will change the frequency selection from the present active frequency to the prior active frequency. When activated with the DNV Formats, the last Format used will be displayed.

[STEP] - This switch is active in the preset channel format, TGT Format and Checkpoint Formats only. Activation of [STEP] will cause the next channel number and frequency to be available for change if needed.

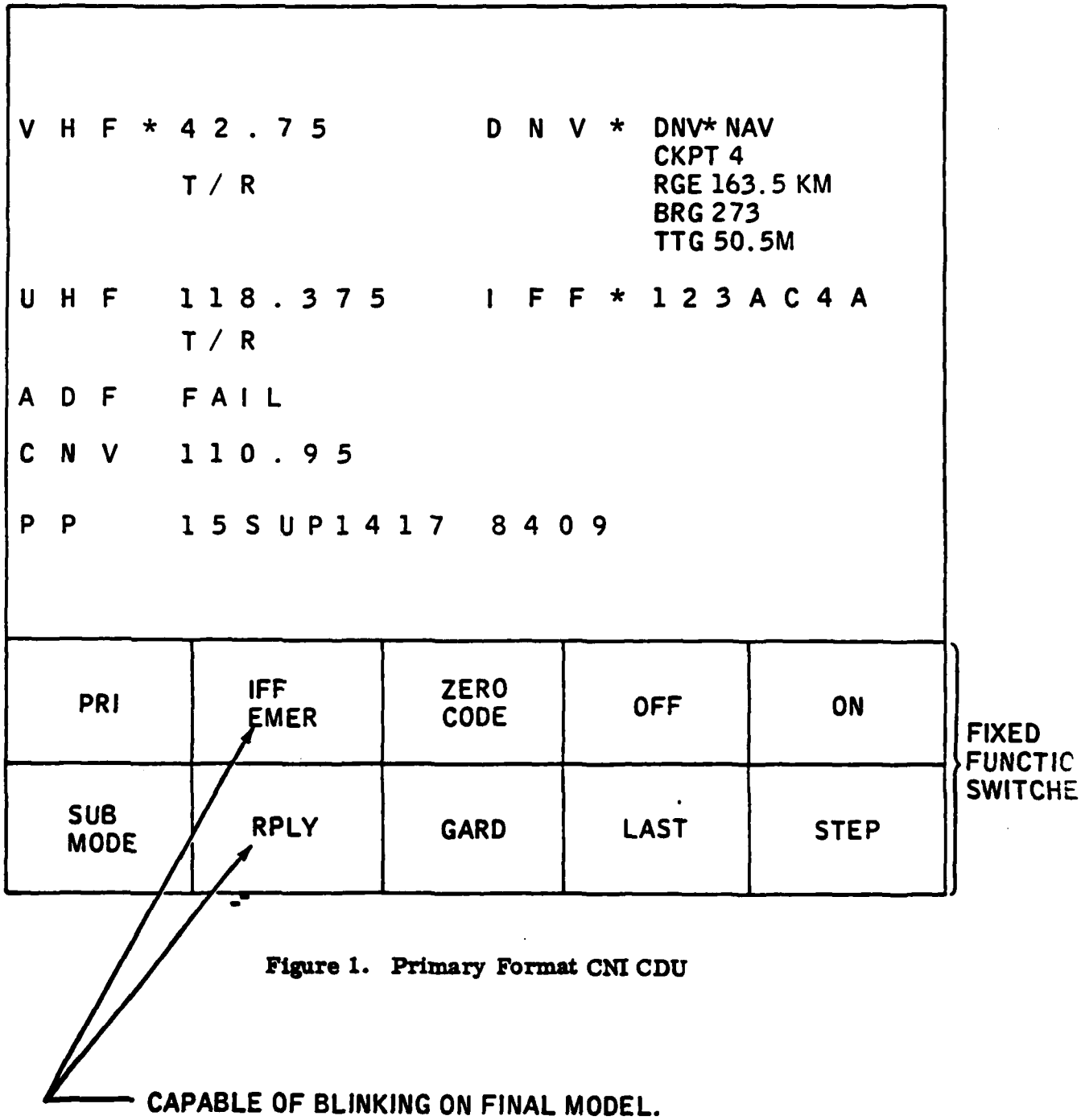


Figure 1. Primary Format CNI CDU

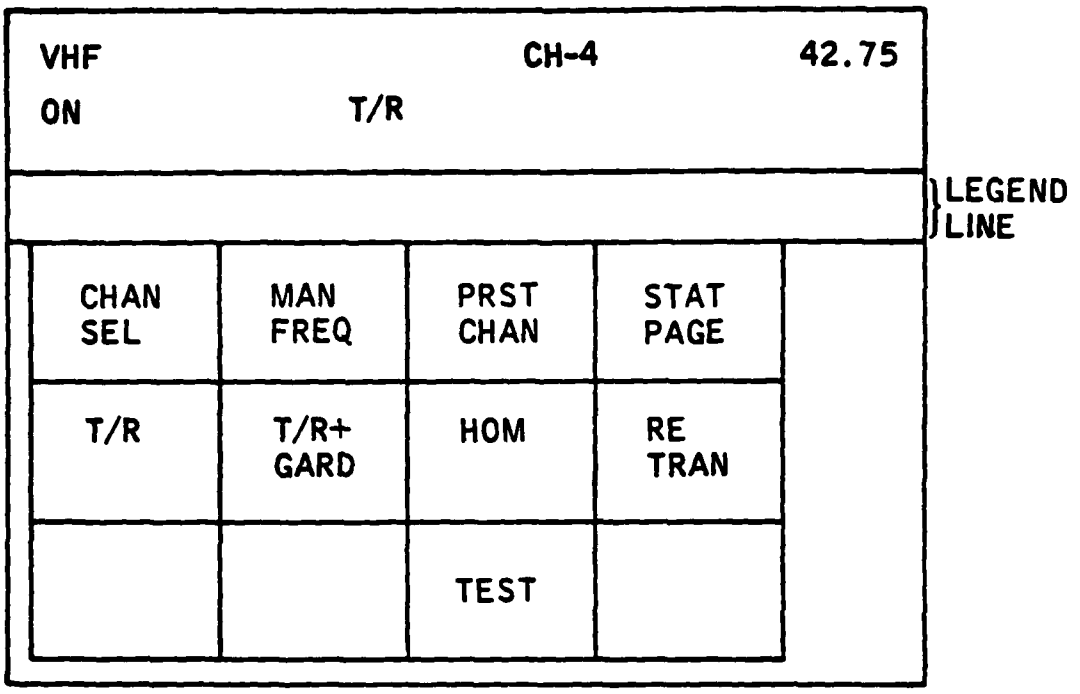


Figure 2. VHF Submode

ON or OFF will display in second line under VHF for indication of ON/OFF status.

	Switch	Format	
From:	VHF	Figure 1	
To:	[CHAN SEL]	Figure 2.A	
	[MAN FREQ]	Figure 2.B	
	[PRST CHAN]	Figure 2.C	
	[STAT PAGE]	Figure 2.D	
	[T/R]	Figure 2	T/R will display in top line
	[T/R + GARD]	Figure 2	T/R + G will display on second line
	[HOM]	Figure 2	HOM will display in top line
	[RETRAN]	Figure 2	RETRAN will display in top line
	[TEST]	Figure 2	OK or FAIL will display on second line

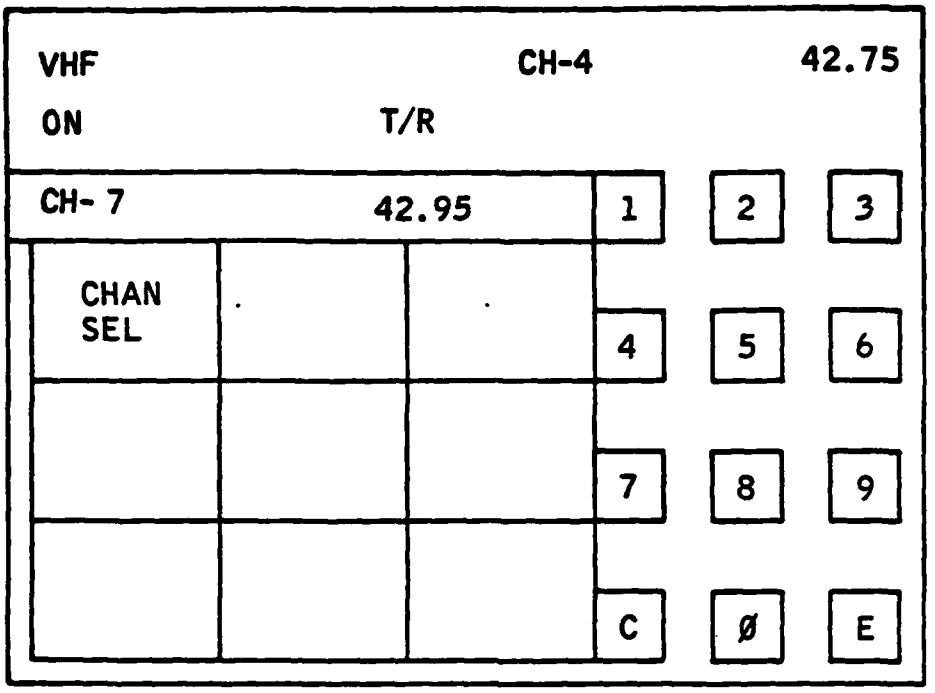


Figure 2.A. VHF Channel Select Format

	Switch	Format
From:	[CHAN SEL]	Figure 2
To:	[E]	Figure 2

This format is used to select the active channel in the following manner:

1. Selection of a numeric from the keyboard will display that numeric in the legend line following CH-. The associated frequency stored in that channel if any will appear in the legend line.
2. [C] may be used to clear the entry for corrective purposes.
3. Selection of [E] will enter the change indicated in the legend line to the radio and switch the display back to Figure 2 where the selected channel number and its associated frequency are displayed in the first line. Legal entries from this format are 0 through 9. [CHAN SEL]switch is not active in this format.

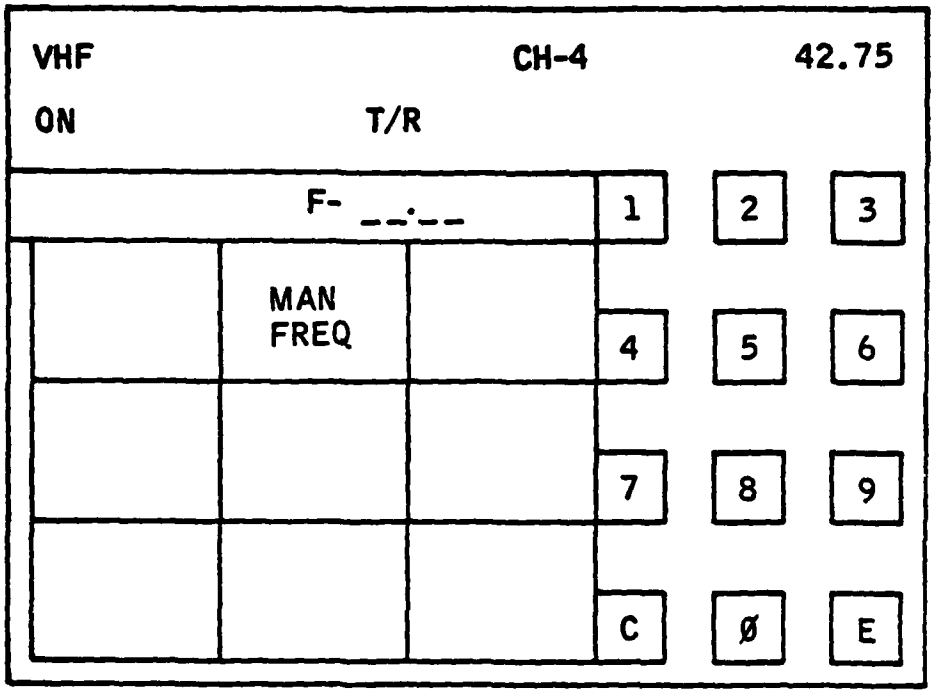


Figure 2.B. *Manual Frequency* Select Format

	Switch	Format
From:	MAN FREQ [FREQ SEL]	Figure 2
To:	[E]	Figure 2

This format is used to change or enter the active frequency in the following manner:

1. **A frequency is entered in the legend line by selecting from the keyboard. Legal entries are from 30.00 to 75.95.**
2. **For corrective purposes, a single activation of [C] will clear the last entered digit and a double activation will clear all of the entered numerics.**
3. **Activation of [E] will place the entered frequency into use and return the display to the VHF Submode Format, Figure 2. The [MAN FREQ] switch is not active in this format.**

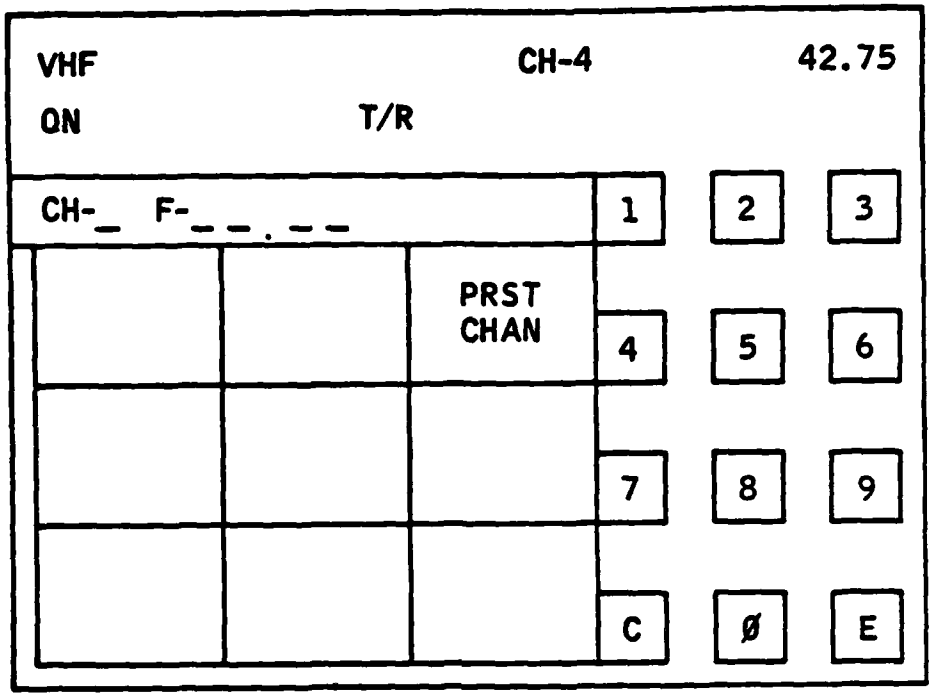


Figure 2.C. Preset Channel Select

	Switch	Format
From:	[PRST CHAN]	Figure 2
To:	[E]	Figure 2

This format is used to preassign frequencies to channels in the following manner:

1. A channel number 0 - 9 is entered in the legend line by selecting from the keyboard. The associated frequency, if any, will also appear in the legend line.
2. The frequency to be assigned to the channel is next entered by use of the keyboard. Legal entries are from 30.00 to 75.95.
3. For corrective purposes, a single action of [C] will clear the last entered digit and a double activation will clear all of the entered numerics.
4. Activation of [E] will place the channel assignment in memory and return to this page with the next channel digit displaced in the legend line. It will continue to step after each entry. Selecting [PRI] or [SET / MODE] will return the display to its respective condition.
5. The channel with its assigned frequency will be displayed on the Preset Channel Format, Figure 2.D, when that format is displayed. [PRST CHAN] is not active in this format.

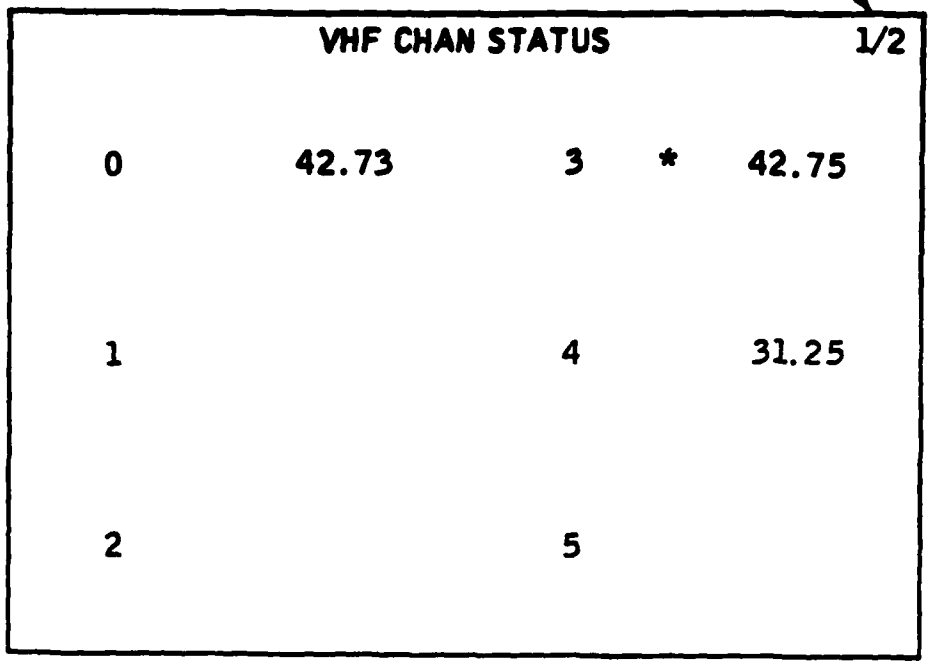


Figure 2. D. Stat Page

	Switch	Format
From:	[STAT PAGE]	Figure 2
To:	0 thru 9	Figure 2.D

This format is primarily a review or status display of the preset channels. An active channel is indicated by the asterisk symbol. A channel can be selected for re-assignment in the following manner:

1. Select channel for re-assignment by pressing on channel legend.
2. Manual frequency select format, Figure 2.B will display with the selected channel and it's associated frequency, if any, displayed in the legend line.
3. A new assignment may be made by entering a new frequency from the keyboard. The channel entry area in the legend line will not be changeable when accessed from the [STAT PAGE] Format.

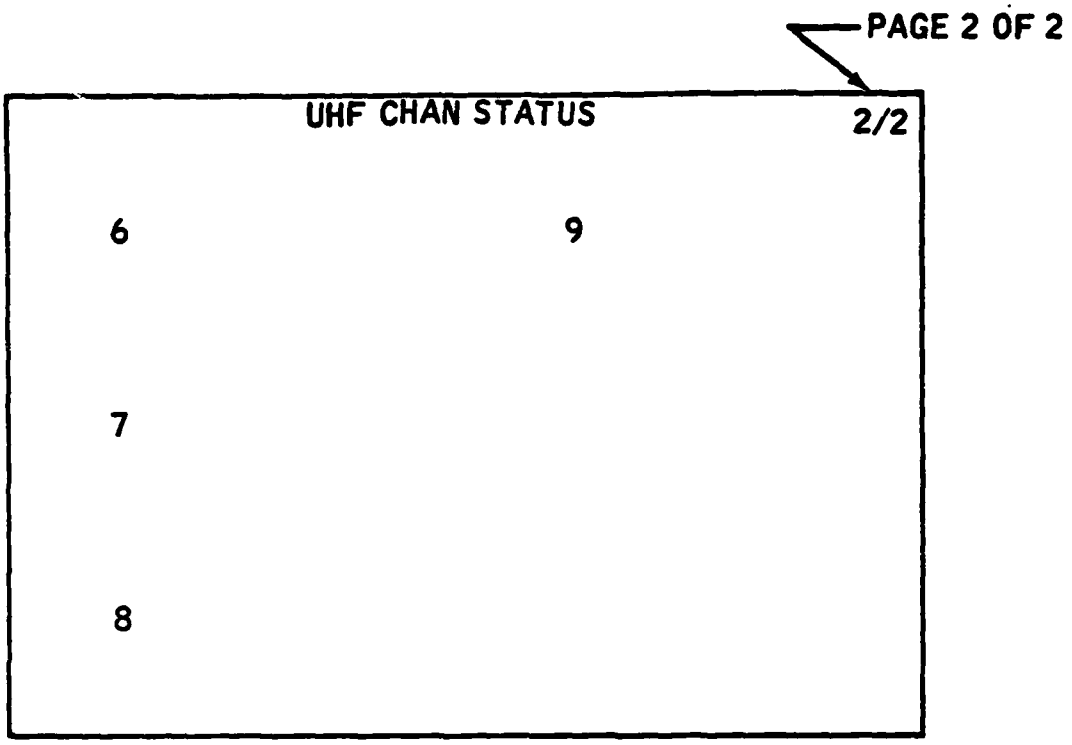


Figure 2.E. Stat Page

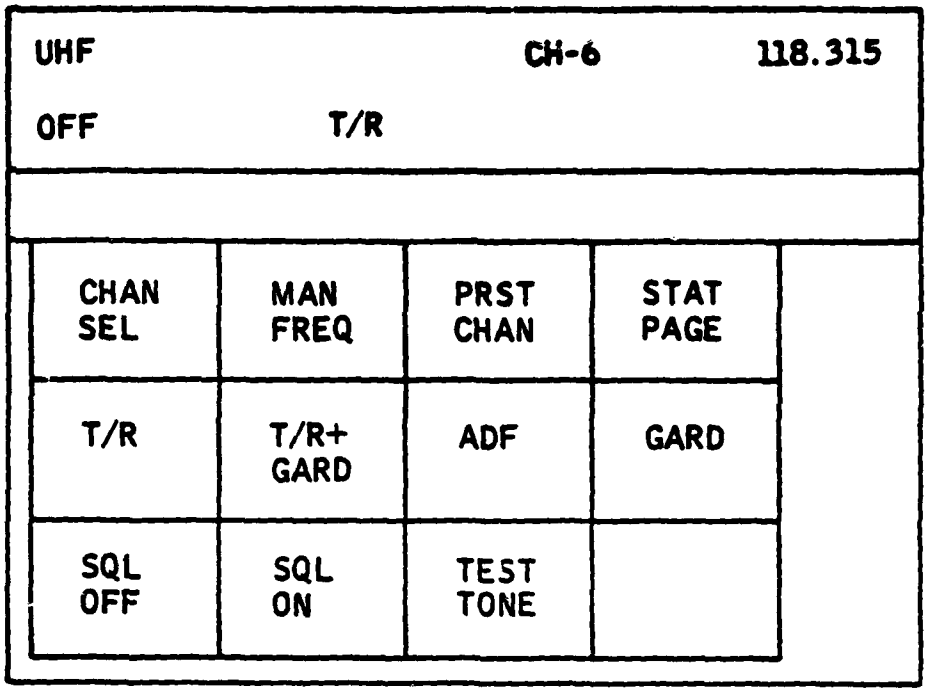


Figure 3. UHF Submode Format

	Switch	Format	
From:	UHF	Figure	
To:	CHAN SEL	Figure 3.A	
	MAN FREQ	Figure 3.B	
	PRST CHAN	Figure 3.C	
	STAT PAGE	Figure 3.D	
	T/R	Figure 3	T/R will display in first line
	T/R + GARD	Figure 3	T/R & GARD will display in first line
	ADF	Figure 3	ADF will display in first line
	GARD	Figure 3	GARD will display in first line
	SQL ON	Figure 3	SQL will display in second line
	SQL OFF	Figure 3	SQL will be erased from second line
	TONE (Momentary)	Figure 3	A tone will be heard in the headset.

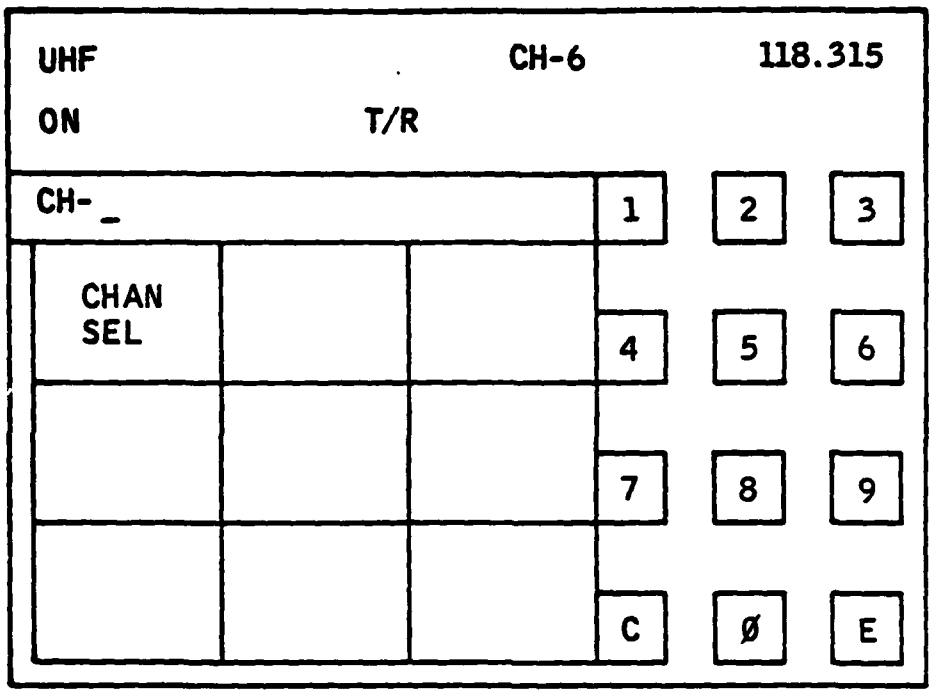


Figure 3.A. UHF Channel Select Format

	Switch	Format
From:	[CHAN SEL]	Figure 3
To:	[E]	Figure 3

This format is used to select an active channel in the following manner:

1. Legal entries for this mode are 0 thru 9.
2. [C] may be used to clear the entry for corrective purposes.
3. Selection of [E] will enter the change indicated in the legend line to the radio and switch the display back to Figure 3 where the selected channel number and it's associated frequency is displayed in the first line. [CHAN SEL] switch is not active in this format.
4. Operation in this mode is the same as that shown on page 6, Figure 2.A for VHF channel select.

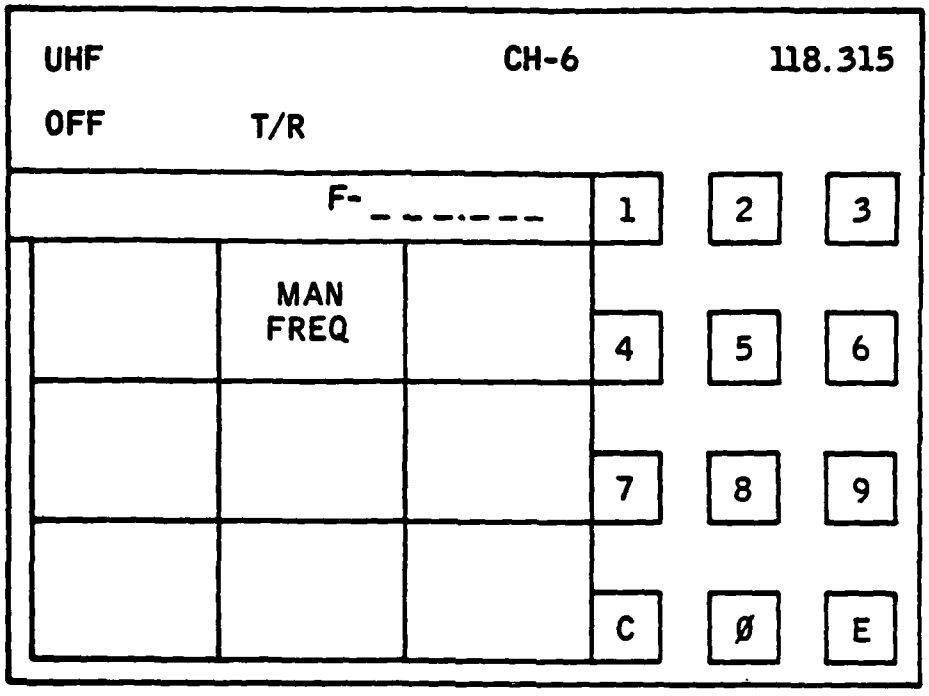


Figure 3.B. UHF Frequency Select Format

	Switch	Format
From:	[MAN FREQ]	Figure 3
To:	[E]	Figure 3

This format is used to select frequencies in the following manner.

1. A frequency is entered in the legend line by selecting from the keyboard. Legal entries are 116.000 to 149.975 .
2. A single activation of [C] will clear the last entered number and a double activation will clear all of the entered numerics for corrective purposes.
3. Activation of [E] will place the entered frequency in use and return the display to the UHF Submode Format, Figure 3. [MAN FREQ] Switch is not active in this format.
4. UHF frequency selection is the same as VHF frequency selection shown on page 8.

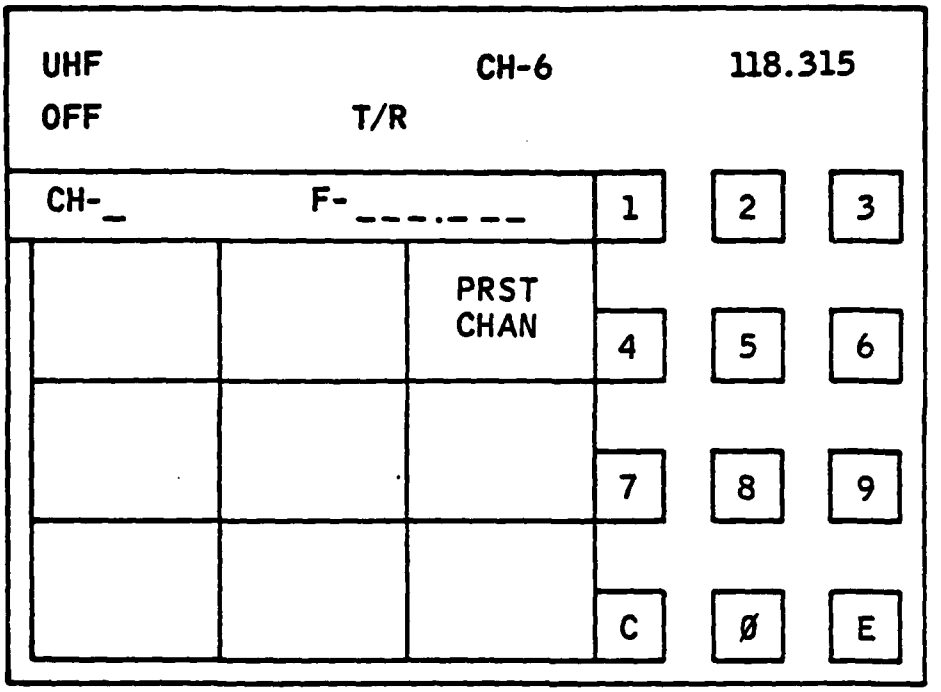


Figure 3.C. Preset Channel Format

	Switch	Format
From:	[PRST CHAN]	Figure 3
To:	[E]	Figure 3

This format is used to pre-assign channels to frequencies in the following manner:

1. A channel number 0 - 9 is entered in the legend line by selecting from the keyboard. The associated frequency, if any, will also appear in the legend line.
2. The frequency to be assigned to the channel is next entered by use of the keyboard. Legal entries are from 30.00 to 75.95.
3. For corrective purposes, a single action of [C] will clear the last entered digit and a double activation will clear all of the entered numerics.
4. Activation of [E] will place the channel assignment in memory and return to this page with the next channel digit displaced in the legend line. It will continue to step after each entry. Selecting [PRI] or [SUB / MODE] will return the display to its respective condition.
5. The channel with its assigned frequency will be displayed on the Preset Channel Format, Figure 2.D, when that format is displayed. [PRST CHAN] is not active in this format.
6. VHF preset channel operations are the same as those used on VHF procedure shown on page 8.

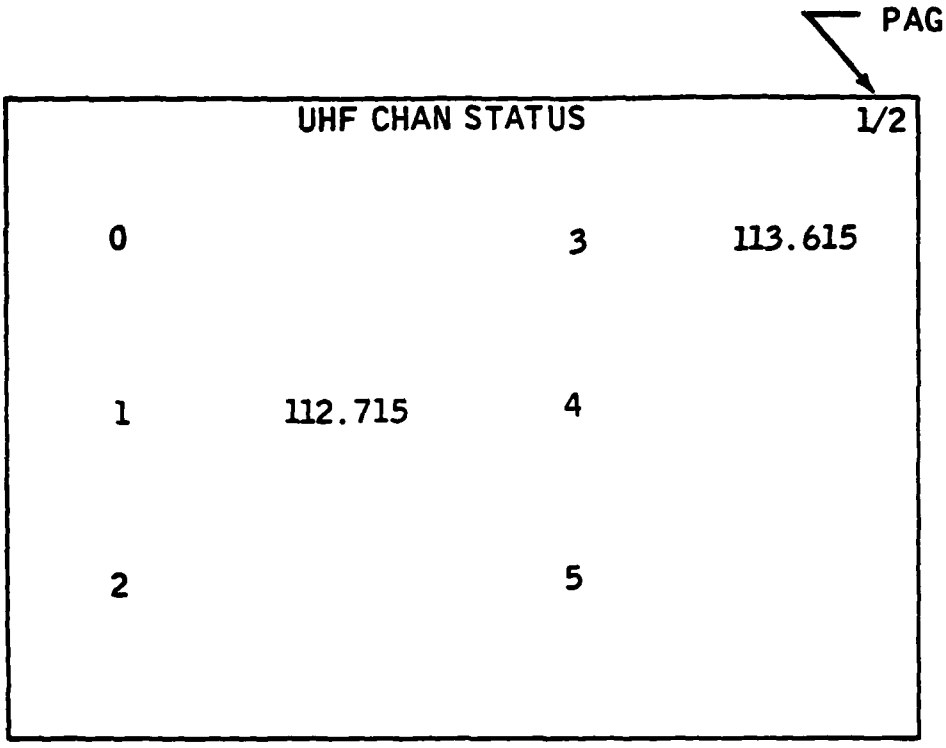


Figure 3.D. Stat Page

	Switch	Format
From:	[STAT PAGE]	Figure 3
To:	CH-0 thru CH-9	Figure 3.D

This format is primarily a review or status display of the preset channels. The active channel is indicated by the asterisk symbol. A channel can be selected for re-assignment in the following manner:

1. Select channel for re-assignment by pressing on channel legend.
2. Manual frequency select format, Figure 3.B will display with the selected channel and its assigned frequency, if any, displayed in the legend line.
3. A new assignment may be made by entering a new frequency from the keyboard. The channel entry area in the legend line will not be changeable when accessed from the [STAT PAGE] Format.
4. This status page will be displayed on two pages. Use step and last to sequence.

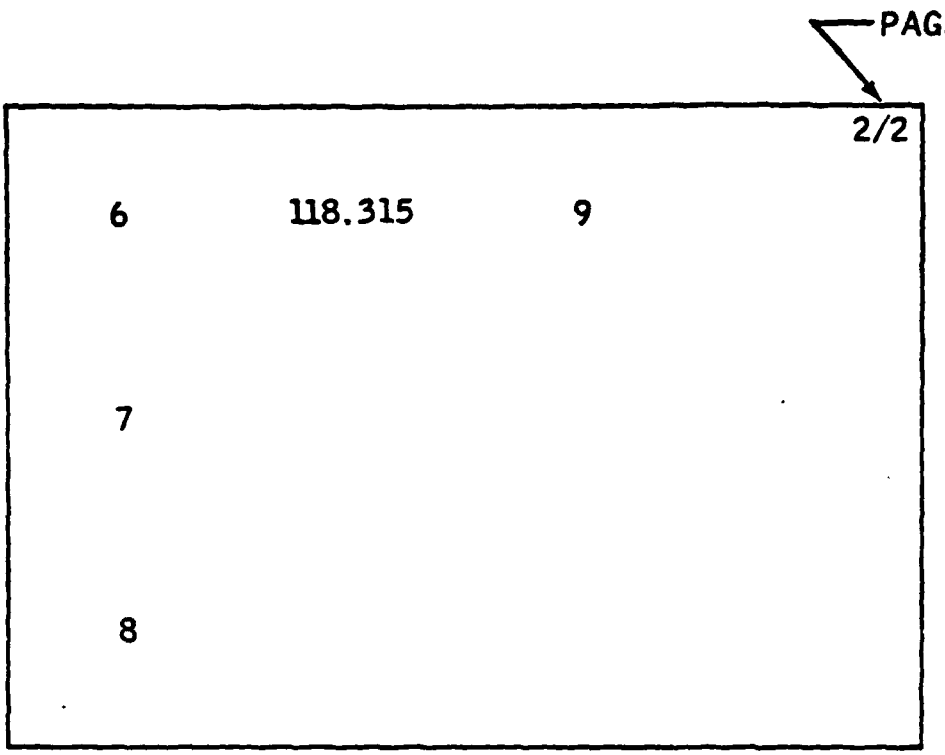


Figure 3.E. Stat Page

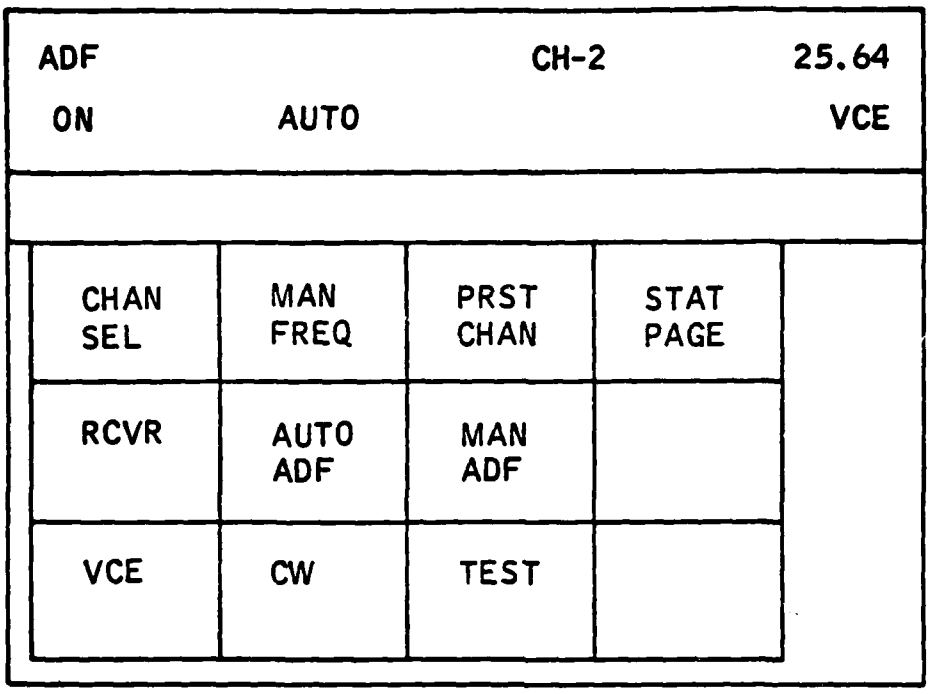


Figure 4. ADF Submode Format

	Switch	Format
From:	ADF	Figure 1
To:	CHAN	Figure 4.A
	MAN FREQ	Figure 4.B
	PRST CHAN	Figure 4.C
	STAT PAGE	Figure 4.D
	RCVR	Figure 4
	AUTO ADF	Figure 4
	MAN ADF	Figure 4
	VCE	Figure 4
	CW	Figure 4
	TEST	Figure 4

Activation of any one of three mutually exclusive switches [RCVR], [AUTO ADF] and [MAN ADF] will display in the second line in the mode display.

Activation of any one of three mutually exclusive switches [VCE], [CW] and [TEST] will display in the second line of the display.

[VCE] allows the ADF to be used as an AM receiver.

[CW] allows the ADF to be used as a CW receiver.

[TEST] will slew the ADF indicator 180°. Test is an automatic 10 second duration.

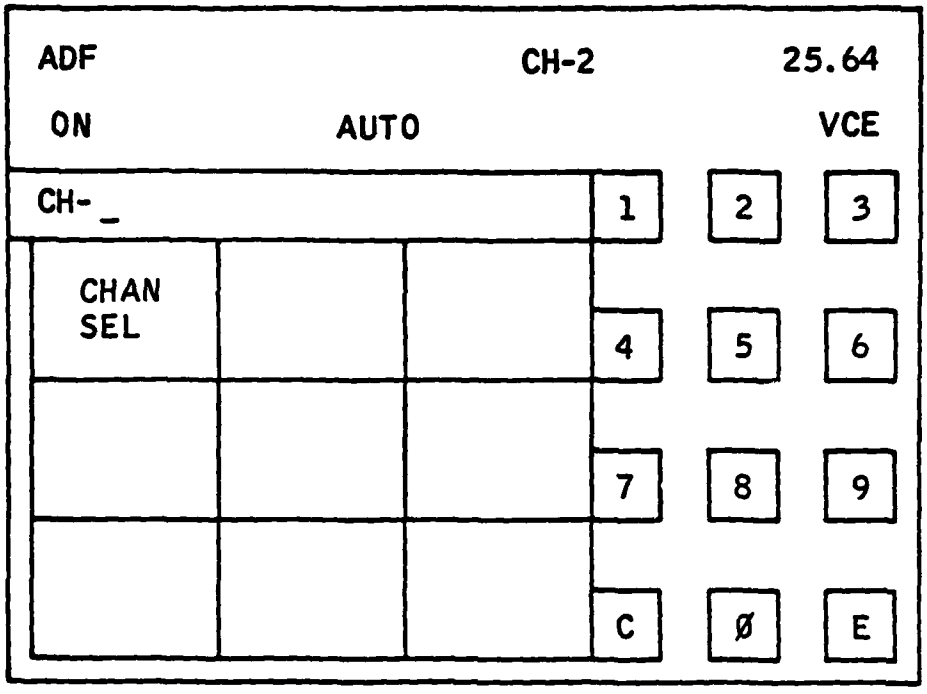


Figure 4. A. Channel Select Format

	Switch	Format
From:	[CHAN SEL]	Figure 4
To:	[E]	Figure 4

This format is used to select an active channel in the following manner:

1. Selection of a numeric from the keyboard will display that numeric on the legend line, or numeric [1] and [9]. The associated frequency stored in that channel will then appear in the legend line.
2. [C] may be used to clear the entry for corrective purposes.
3. Selection of [E] will enter the change indicated in the legend line to the radio and switch the display back to Figure 4 where the selected channel number and its associated frequency is displayed in the first line. Legal entries from this format are 0 thru 9. [CHAN SEL] switch is not active in this format.
4. Procedure to be similar to those shown on pages 6, 11, 16.

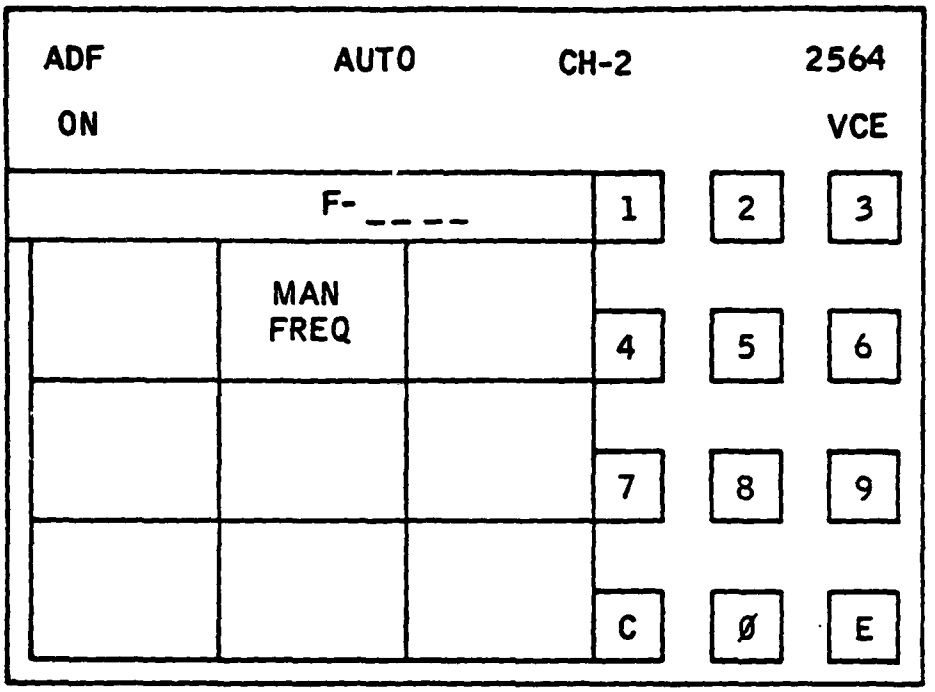


Figure 4.B. Frequency Select Format

	Switch	Format
From:	MAN FREQ	Figure 4
To:	E	Figure 4

This format is used to select frequencies in the following manner:

1. A frequency is entered in the legend line by selecting from the keyboard. Legal entries are 100 KHZ to 3000 KHZ.
2. A single activation of [C] will clear the last entered number and a double activation will clear all of the entered numerics for corrective purposes.
3. Activation of [E] will place the entered frequency in use and return the display to the ADF Submode Format, Figure 4. [MAN FREQ] switch is not active in this format.

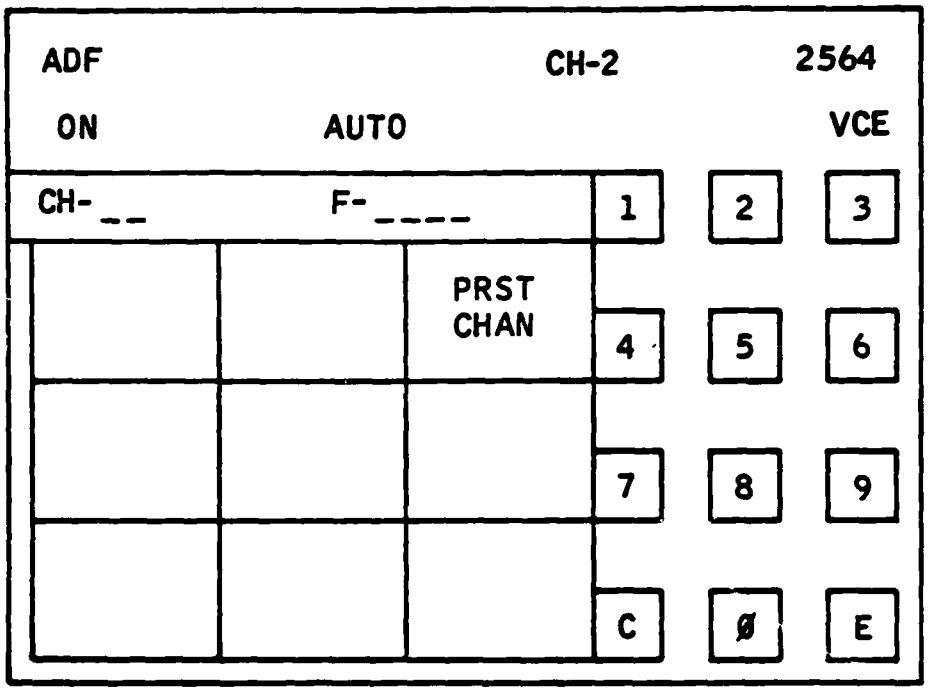


Figure 4.C. Preset Channel

	Switch	Format
From:	[PRST CHAN]	Figure 4
To:	E	Figure 4

This format is used to pre-assign channels to frequencies in the following manner:

1. A channel number 0 - 9 is entered in the legend line by selecting from the keyboard. The associated frequency, if any, will also appear in the legend line.
2. The frequency to be assigned to the channel is next entered by use of the keyboard. Legal entries are from 30.00 to 75.95.
3. For corrective purposes, a single action of [C] will clear the last entered digit and a double activation will clear all of the entered numerics.
4. Activation of [E] will place the channel assignment in memory and return to this page with the next channel digit displaced in the legend line. It will continue to step after each entry. Selecting [PRI] or [SUB / MODE] will return the display to its respective condition.
5. The channel with its assigned frequency will be displayed on the Preset Channel Format, Figure 2.D, when that format is displayed. [PRST CHAN] is not active in this format.
6. Procedures are similar to those shown on pages 8, 12 & 23.

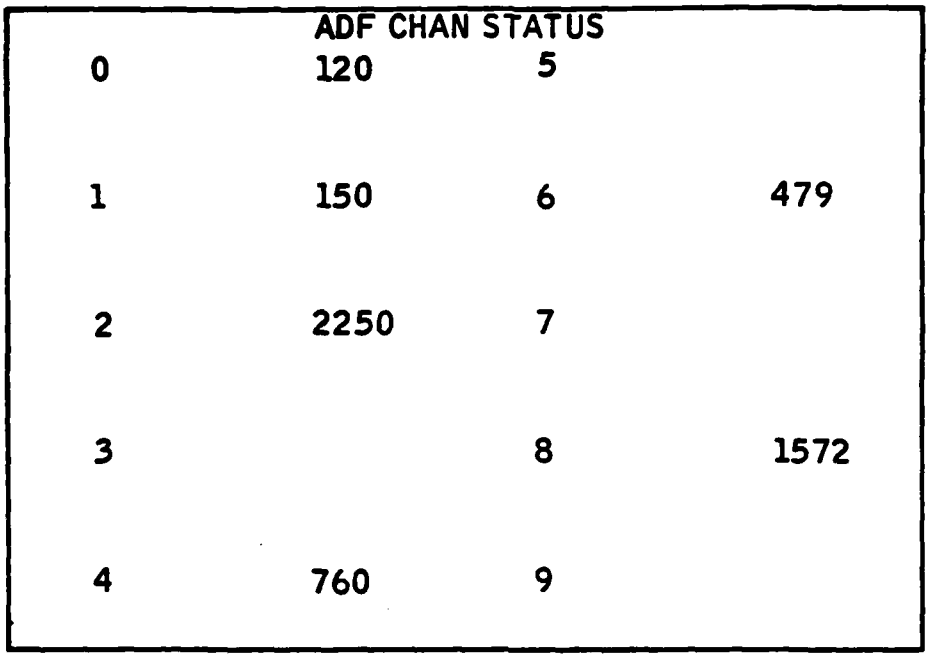


Figure 4.D. Stat Page

	Switch	Format
From:	STAT PAGE	Figure 4
To:	0 thru 9	Figure 4.B

This format is primarily a review or status display of the preset channels. The active channel is indicated by the asterisk symbol. A channel can be selected for re-assignment in the following manner:

1. Select channel for re-assignment by pressing on channel legend.
2. Frequency selection format, Figure 4.B will display with the selected channel and its assigned frequency, if any, displayed in the legend line.
3. A new assignment may be made by entering a new frequency from the keyboard. The channel entry area in the legend line will not be changeable when accessed from the Preset Channels Format.

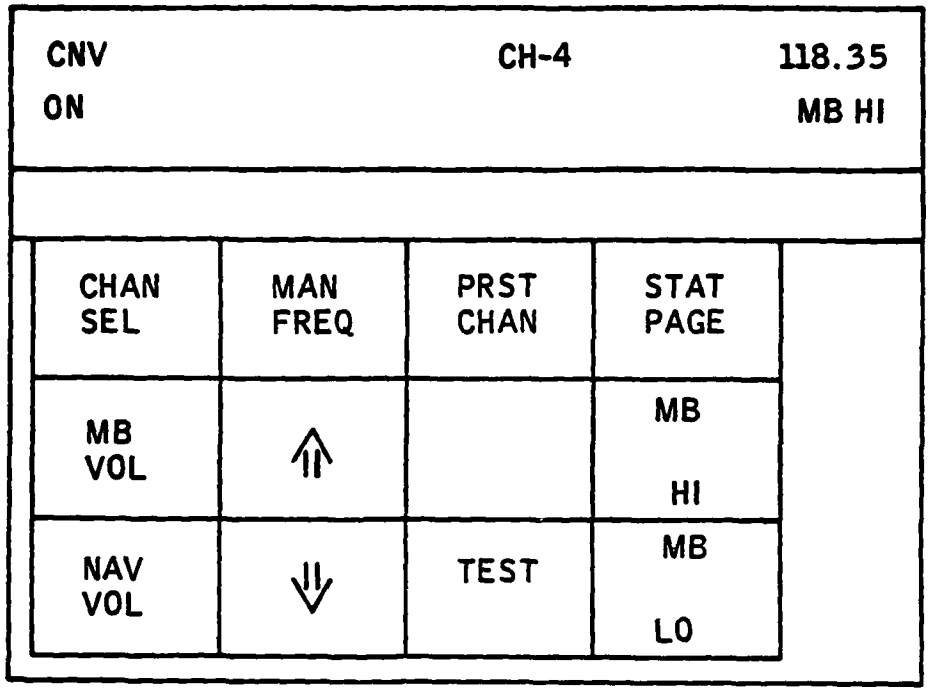


Figure 5. CNV Submode Format

	Switch	Format
From:	CNV	Figure 1
To:	CHAN SEL	Figure 5.A
	MAN FREQ	Figure 5.B
	PRST CHAN	Figure 5.C
	STAT PAGE	Figure 5.D
	MB VOL	Figure 5
	MB HI	Figure 5
	MB LO	Figure 5
	NAV VOL	Figure 5
	TEST	Figure 5

[MB HI] - Activation of [MB HI] will place the receiver in the marker beacon high sensitivity mode and display "MB HI" in the second line of the display.

[MB LO] - Activation of [MB LO] will place the receiver in the marker beacon low sensitivity mode and display "MB LO" in the second line of the display.

[TEST] - External test equipment is needed and the test indications are displayed on external equipment. This is a momentary switch.

[MB VOL] - Selection of [MB VOL] will allow control of the volume by use of the up or down arrow symbol keys.

[NAV VOL] - Selection of [NAV VOL] will allow control of the volume by use of the up or down arrow symbol keys.

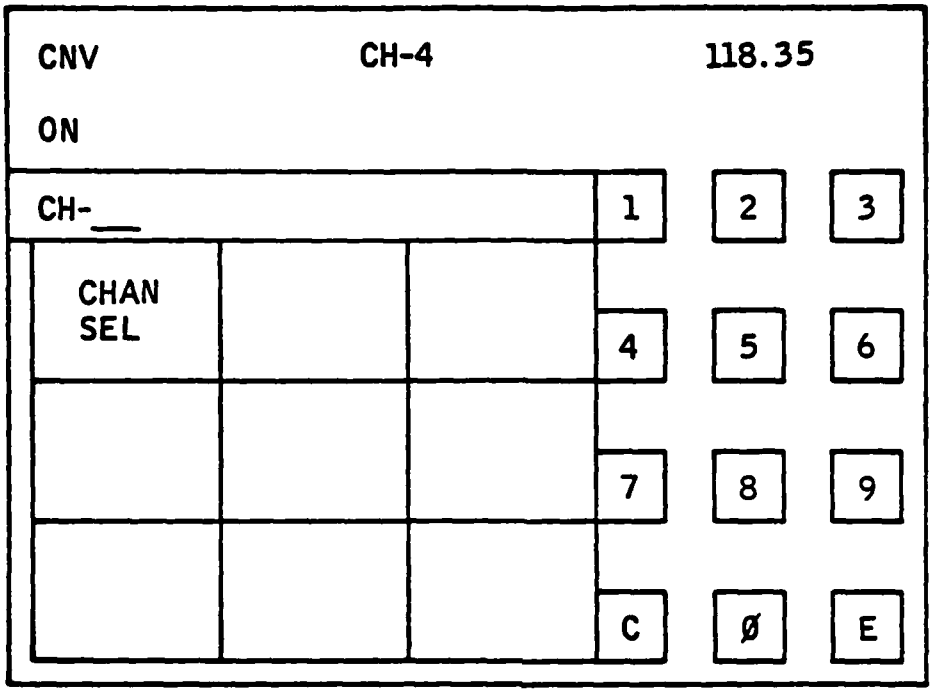


Figure 5.A. Channel Select Format

	Switch	Format
From:	CHAN SEL	Figure 5
To:	E	Figure 5

This format is used to select an active channel in the following manner:

1. Selection of a numeric from the keyboard will display that numeric in the legend line following CH-. The associated frequency if stored in that channel will appear in the legend line.
2. [C] may be used to clear the entry for corrective purposes.
3. Selection of [E] will enter the change indicated in the legend line to the radio and switch the display back to Figure 5 where the selected channel number and it's associated frequency is displayed in the first line. Legal entries from this format are 0 through 9. [CHAN SEL] switch is not active in this format.
4. Procedures are similar to those shown on pages 6, 11, 16.

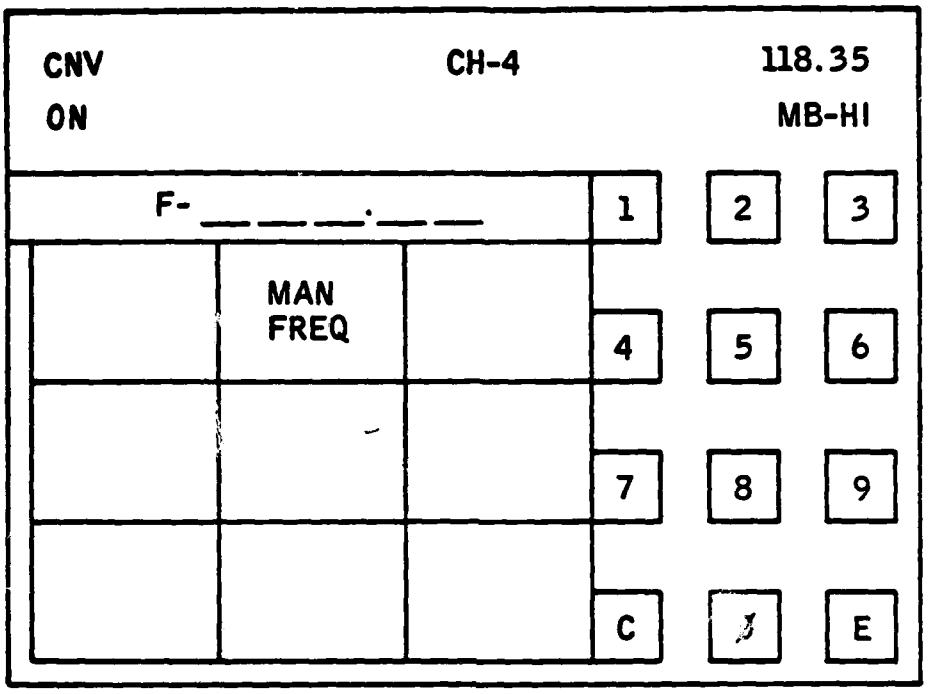


Figure 5.B. Frequency Select Format

	Switch	Format
From:	MAN FREQ	Figure 5
To:	E	Figure 5

This format is used to select frequencies in the following manner:

1. A frequency is entered in the legend line by selecting from the keyboard. Legal entries are 108.00 MHz to 117.95 MHz.
2. A single activation of [C] will clear the last entered number and a double activation will clear all of the entered numerics for corrective purposes.
3. Activation of [E] will place the entered frequency in use and return the display to the CNV Submode Format, Figure 5. The [MAN FREQ] switch is not active in this form.

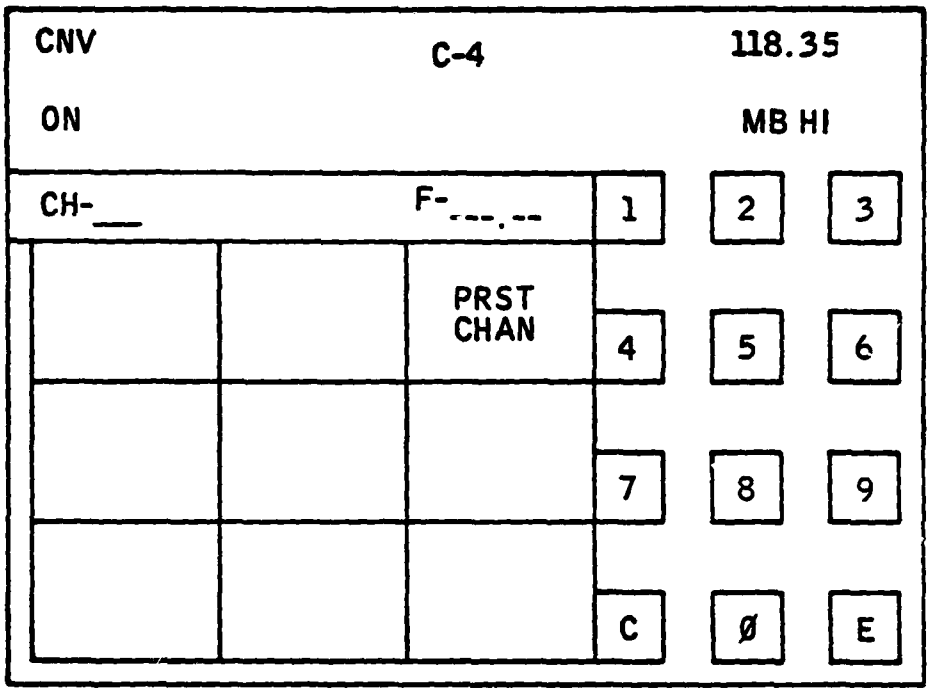


Figure 5.C. Preset Channel Format

	Switch	Format
From:	PRST CHAN	Figure 5
To:	*NUMERIC + E*	Figure 5

This format is used to pre-assign channels to frequencies in the following manner.

1. A channel number 0 - 9 is entered in the legend line by selecting from the keyboard. The associated frequency, if any, will also appear in the legend line.
2. The frequency to be assigned to the channel is next entered by use of the keyboard. Legal entries are from 30.00 to 75.95.
3. For corrective purposes, a single action of [C] will clear the last entered digit and a double activation will clear all of the entered numerics.
4. Activation of [E] will place the channel assignment in memory and return to this page with the next channel digit displaced in the legend line. It will continue to step after each entry. Selecting [PRI] or [SUB / MODE] will return the display to its respective condition.
5. The channel with its assigned frequency will be displayed on the Preset Channel Format, Figure 2.D, when that format is displayed. [PRST CHAN] is not active in this format.

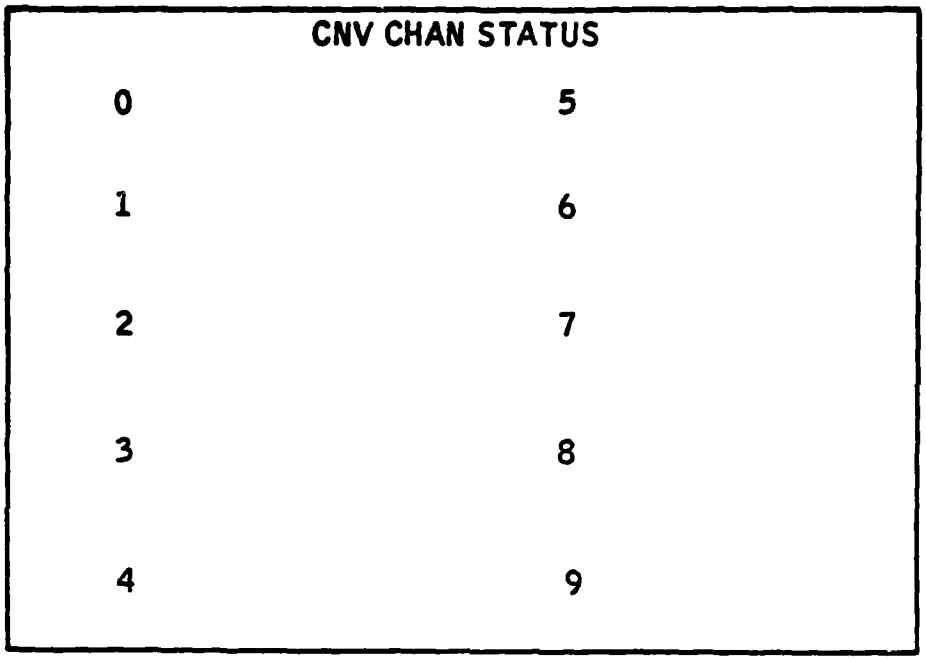


Figure 5.D. Stat Page

	Switch	Format
From:	[STAT PAGE]	Figure 5
To:	0 thru 9	Figure 5.b

This format is primarily a review or status display of the preset channels. The active channel is indicated by the asterisk symbol. A channel can be selected for re-assignment in the following manner.

1. Select channel for re-assignment by pressing on channel legend.
2. Frequency selection format, Figure 5.B will display with the selected channel and it's assigned frequency, if any, displayed in the legend line.
3. A new assignment may be made by entering a new frequency from the keyboard. The channel entry area in the legend line will not be changeable when accessed from the Preset Channels Format.

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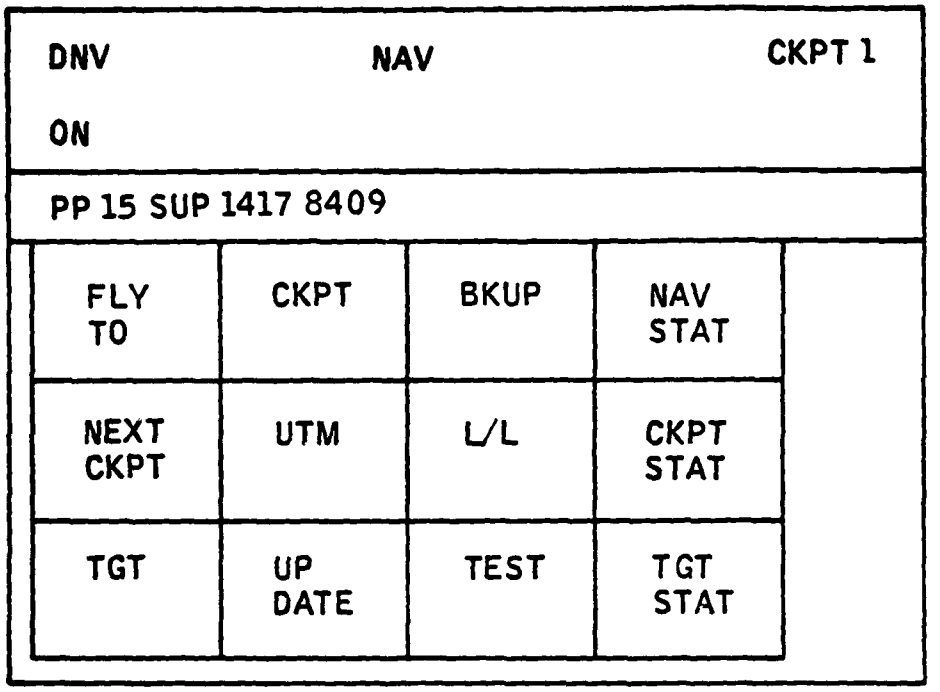


Figure 6. DNV Submode Format

	Switch	Format
From:	DNV	Figure 1.
To:	FLY TO + CKPT or TGT	Figure 6A
	CKPT	Figure 6B
	NAV STAT	Figure 6D
	NEXT CKPT	(See below)
	BKUP NAV	Figure 6F
	CKPT STAT	Figure 6G
	TGT	Figure 6C
	UP DATE	Figure 6H
	TEST	(See below)
	TGT STAT	Figure 6I

Activation of [NEXT CKPT] will increment the FLY TO checkpoint number by one and all data will now be referenced to the new checkpoint number.

Activation of [TEST] will display a momentary message in the legend line of the display. "OK" for no failure and "FAIL" for a failure.

Activation of [L/L] or [UTM] will present information in lat long or UTM coordinates.

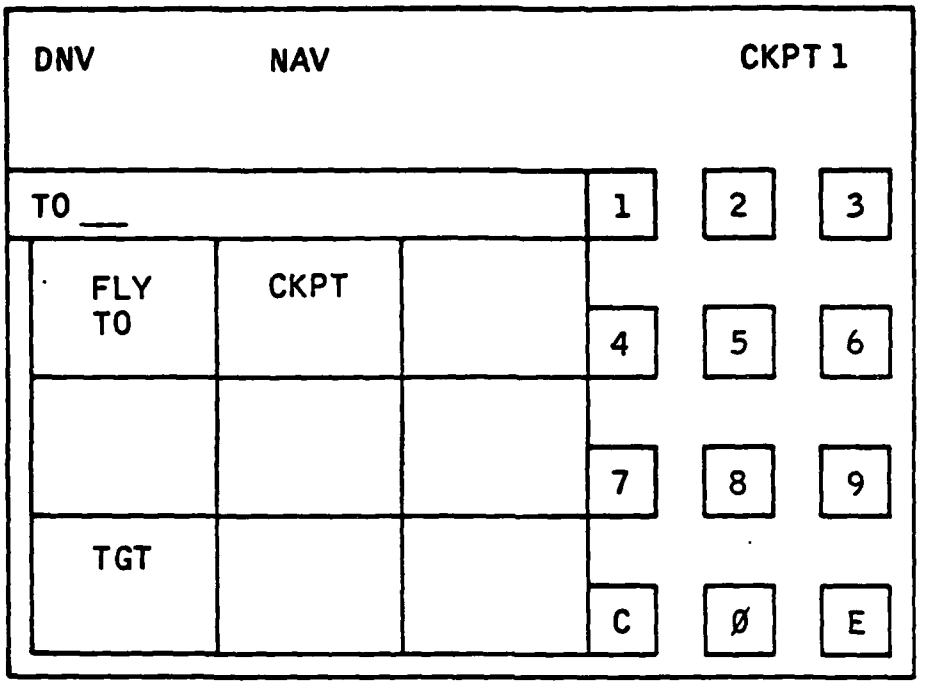


Figure 6.A. Fly to CKPT or TGT Format

	Switch	Format
From:	[FLY TO] + [CKPT] or [TGT]	Figure 6
To:	[FLY TO]	No Action
	[CKPT] + Numeric	Figure 6
	or [TGT] + Numeric + E	Figure 6

This format is used to select either a checkpoint or target as the point to compute NAV data related to present position.

1. Selection of [CKPT] will display CKPT after "TO" in the legend line.
2. After Selection of [CKPT] one numeric must be entered from the keyboard and will display after "CKPT".
3. Selection of [E] will enter this data to the DNV System and return the display to Figure 6. The entered numeric will now display in the upper right hand area of the display after "CKPT".
4. Selection of [TGT] + numeric will change the display back to Figure 6 and display "TGT" + numeric in the upper right hand area of the display.

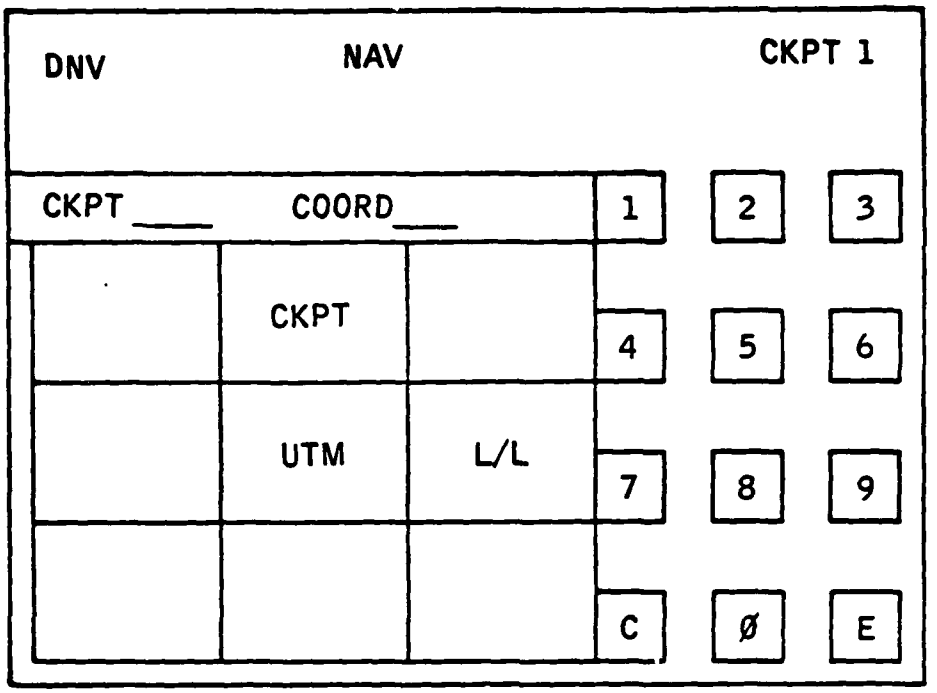


Figure 6.B. CKPT Entry Format

	Switch	Format
From:	[CKPT]	Figure 6
To:	[UTM]	Figure 6.B.1
	[L/L]	Figure 6.B.2

This format is used to enter the Checkpoint Number and select the Coordinate system for the checkpoint entry. Selection of UTM as L/L will place the CDU in that mode for entry of coordinates. The converse coordinate would be computed by the Doppler NAV unit and be available to the CDU for display.

1. The Checkpoint number is entered via the numeric keyboard and displayed in the legend line.
2. [UTM] or [L/L] is selected for the coordinate entry system.
3. Selection of [E] will display Figure 6.B.1 with the checkpoint + number displayed in the upper right hand corner.

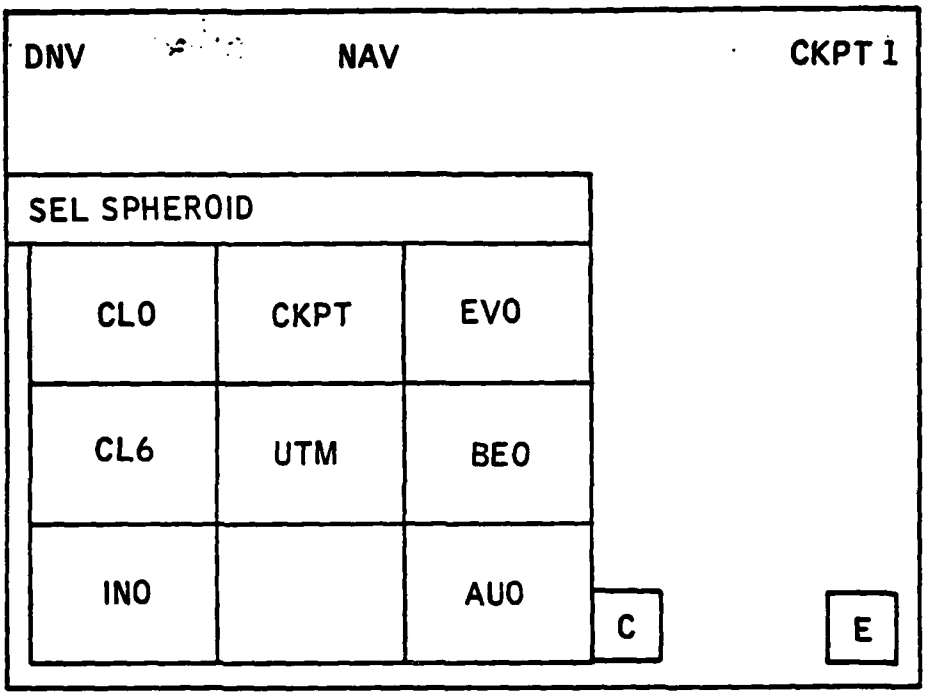


Figure 6.B.1. UTM Coordinate Entry Format

	Switch	Format
From:	[E]	Figure 6.B
To:	[CLO]	Figure 6.B.1.1
	[EVO]	Figure 6.B.1.1
	[CL6]	Figure 6.B.1.1
	[BEO]	Figure 6.B.1.1
	[INO]	Figure 6.B.1.1
	[AUO]	Figure 6.B.1.1

This format is used to enter the UTM Spheroid. Selection of any one of the six spheroids will display Figure 6.B.1.1 and display the Selected Spheroid in the right hand side of the second line of display.

This Format can be bypassed by the use of [STEP] in the Fixed Switches.

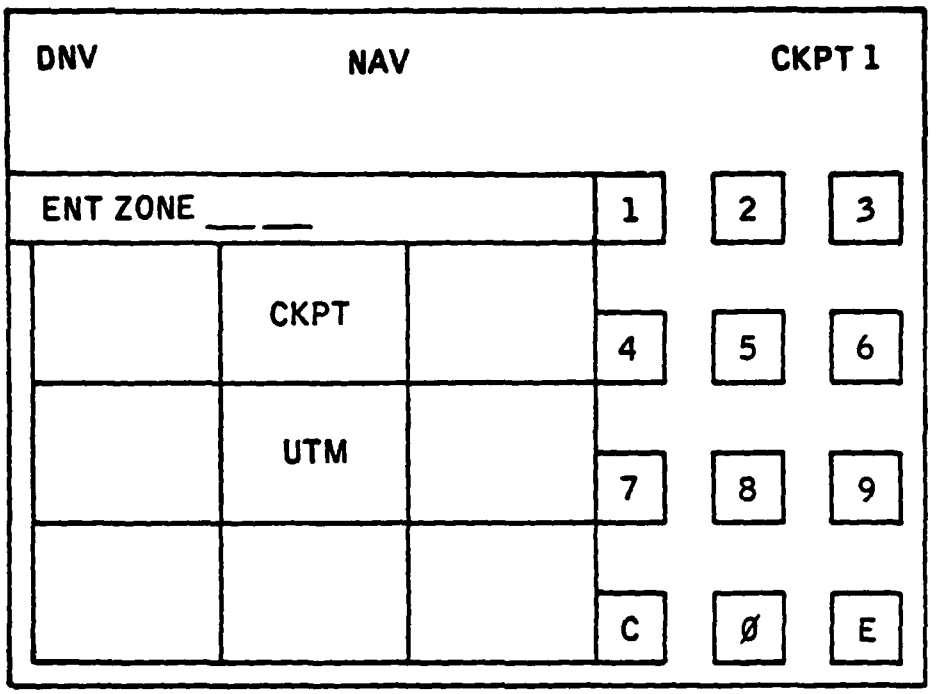


Figure 6.B.1.1. UTM Numeric Entry Format

	Switch	Format
From:	[CLO]	Figure 6.B.1
	[EVO]	Figure 6.B.1
	[CL6]	Figure 6.B.1
	[BEO]	Figure 6.B.1
	[INO]	Figure 6.B.1
	[AUO]	Figure 6.B.1
To:	[E]	Figure 6.B.1.2
	[E]	Figure 6.B.1.3

This format is used to enter the first two numerics (ZONE) in the UTM Coordinate System.

1. Enter two numerics (Legal entry 1-60). The numeric will display in the legend line.

2. Select [E] to enter the numerics. Alpha entry display Figure 6.B.1.2 will display.

DNV 15 SUP			NAV				CKPT 1
A	B	C	D	E	F	G	H
I	J	K	L	M	N	O	P
Q	R	S	T	U	V	W	X
Y	Z				C		E

Figure 6.B.1.2. UTM Alpha entry Format

	Switch	Format
From:	[E]	Figure 6.B.1.1
To:	[E]	Figure 6.B.1.1

This format is used to enter the area alphas in the UTM Coordinate system. A total of three alphas will be entered from this format. Legal entries are C thru X with I and O omitted.

1. Enter three alphas which will display as shown.
2. Select [E] to enter the alphas. Figure 6.B.1.1 will display for entry of the final numerics. (Legal entry 8 digits.)
3. After completion of Numeric entry from Figure 6.B.1.1, actuation of E will display Figure 6.B.1.3.

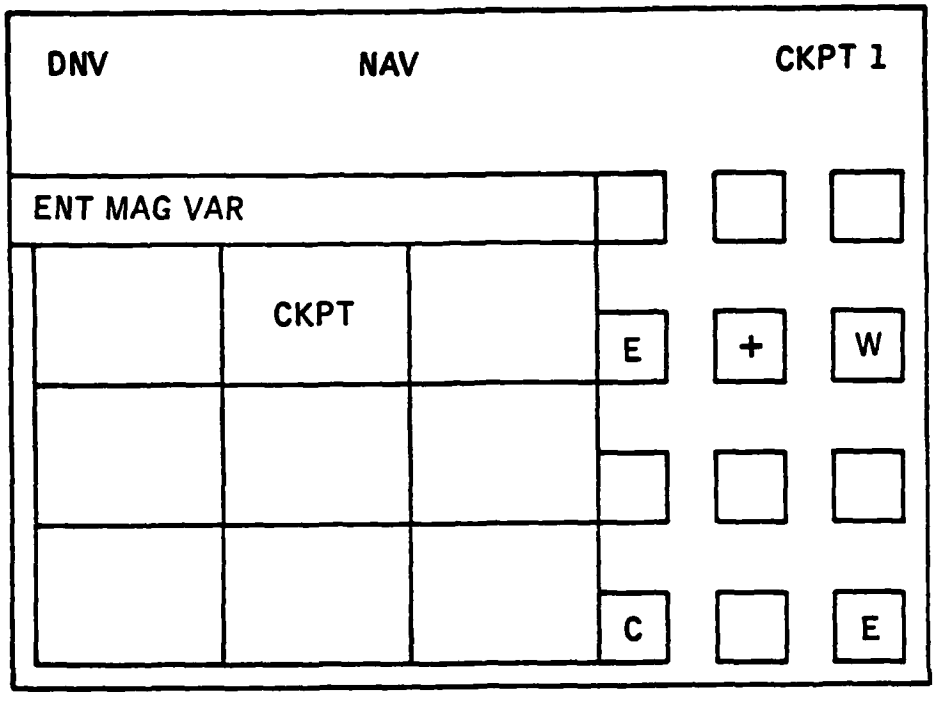


Figure 6.B.1.3. Mag VAR Entry Format

	Switch	Format
From:	[E]	Figure 6.B.1.1
To:	[E]	Figure 6.B.1.1

This format is used to enter the E or W for magnetic variation of the checkpoint.

1. Enter [E] or [W] for the MAG VAR.
2. Select [E] to enter the data. Figure 6.B.1.4 will display for entry of numerics. -"
3. Select [E] from 6.B.1.4 after numerics have been entered will enter the data and display Figure 6, DNV Submode format.
4. Activation [STEP] will place the same MAG VAR if any as inserted for the previous CKPT or TGT. Display will return to Figure 6.B.

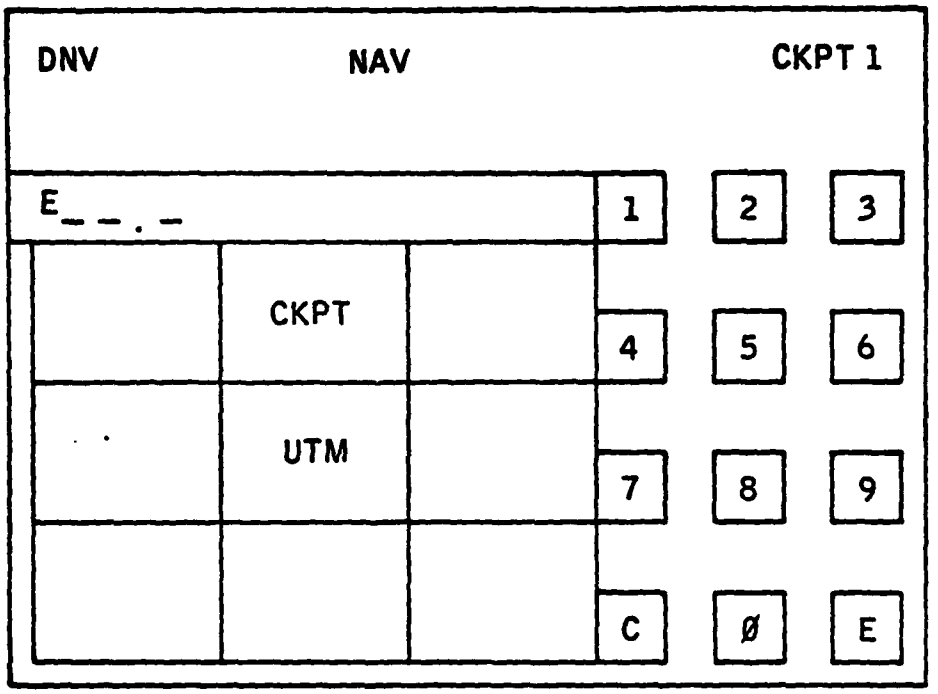


Figure 6.B.1.4. UTM Numeric Entry Format

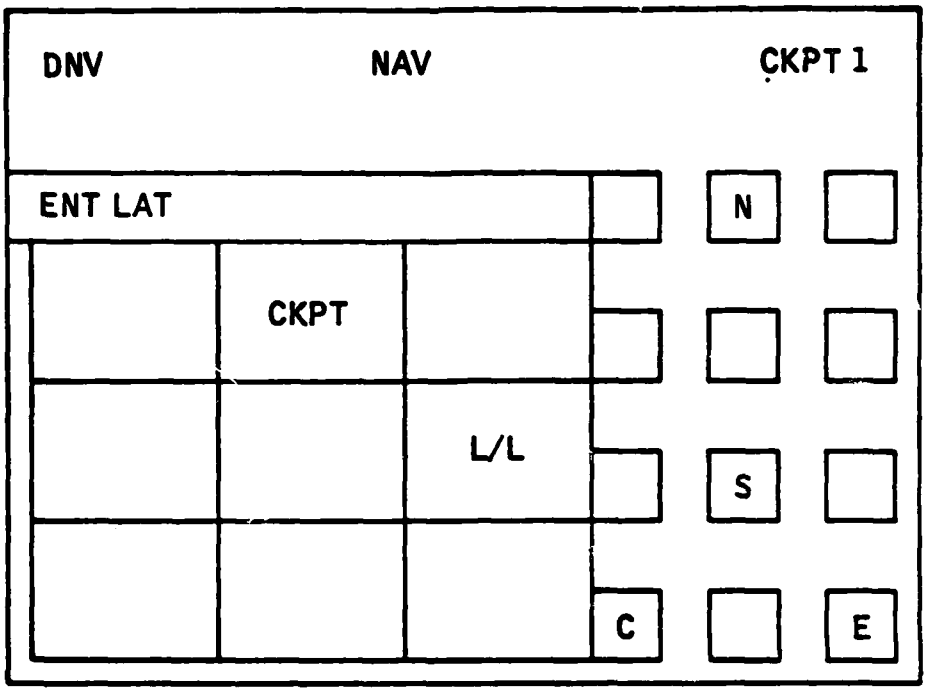


Figure 6.B.2. L/L Coordinate Entry Format

	Switch	Format
From:	[L/L]	Figure 6.B
To:	[E]	Figure 6.B.2.1

This format is used to enter the N or S direction for Latitude.

1. Select [N] or [S] from the keyboard.
2. Select [E] to enter the data and display Figure 6.B.2.1 for further numeric entry.

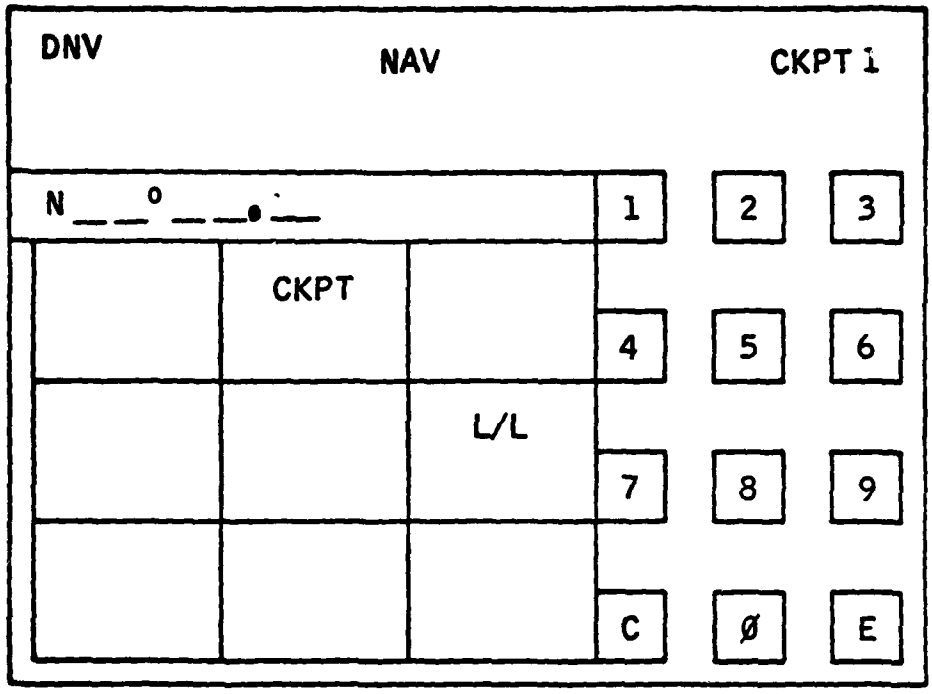


Figure 6.B.2.1. L/L Numeric Entry Format

	Switch	Format
From:	[E]	Figure 6.B.2
To:	[E]	Figure 6.B.2.2

This format is used to enter the numeric for the Latitude.

1. Select Numeric from the keyboard.
2. Select [E] to enter the numeric and display Figure 6.B.2.2 for entry of Longitude direction.

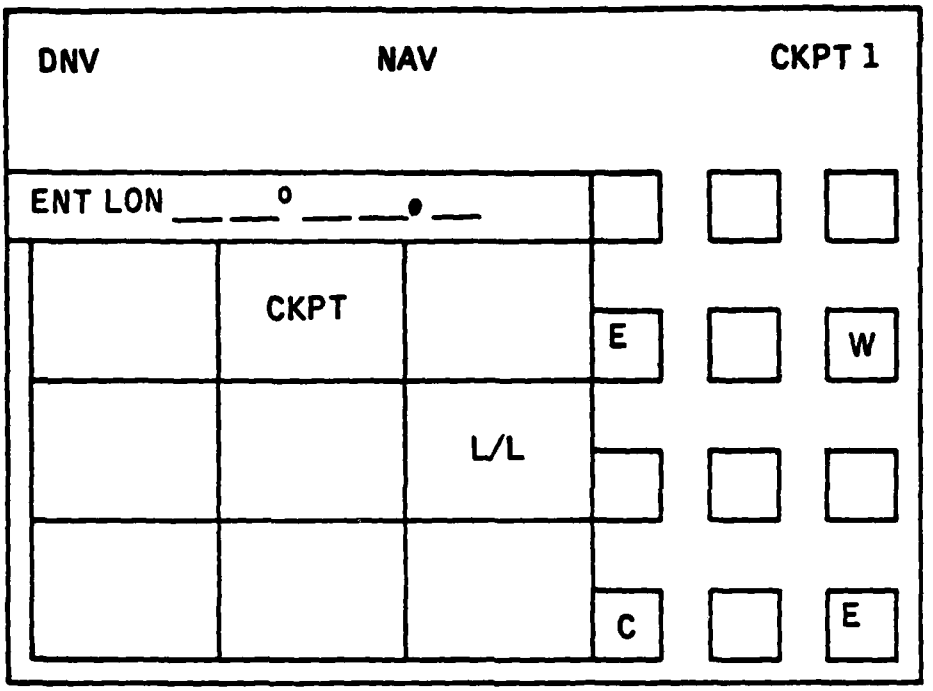


Figure 6.B.2.2. Longitude Direction Entry Format

	Switch	Format
From:	[E]	Figure 6.B.2.1
To:	[E]	Figure 6.B.2.1

This format is used to enter the East or West direction of the longitude.

1. Select [E] or [W] for direction from the keyboard.
2. Select [E] to enter the data and display Figure 6.B.2.1 for entry of numeric data for longitude.
3. After completion of entry of numeric data, Selection of [E] from Figure 6.B.2.1 will display Figure 6.B.2.3.

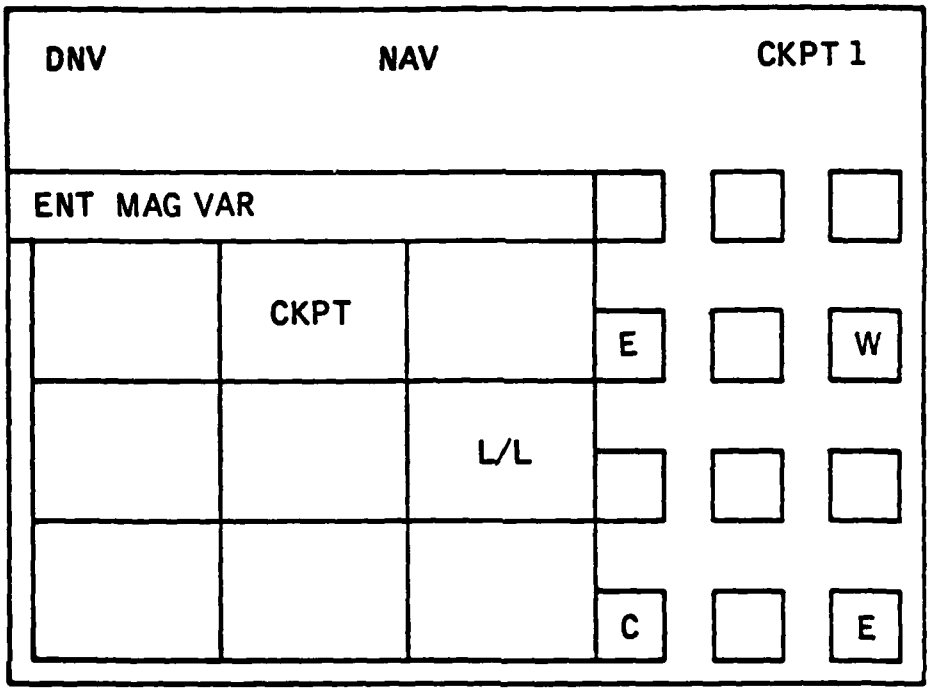


Figure 6.B.2.3. CHECKPOINT or TARGET MAG VAR Entry Format

	Switch	Format
From:	[E]	Figure 6.B.2.1
To:	[E]	Figure 6.B.1.4

This format is used to enter the E or W for Magnetic Variation of the checkpoint.

1. Select [E] or [W] from the keyboard area.
2. Select [E] to enter the data and display Figure 6.B.2.1 for entry of three numerics.
3. After entry of three numerics from Figure 6.B.2.1, selection of [E] will enter the data and display Figure 6.
4. Activation of [STEP] will place the same MAG VAR as inserted for the previous CKPT or TGT. Display will Return to 6B.

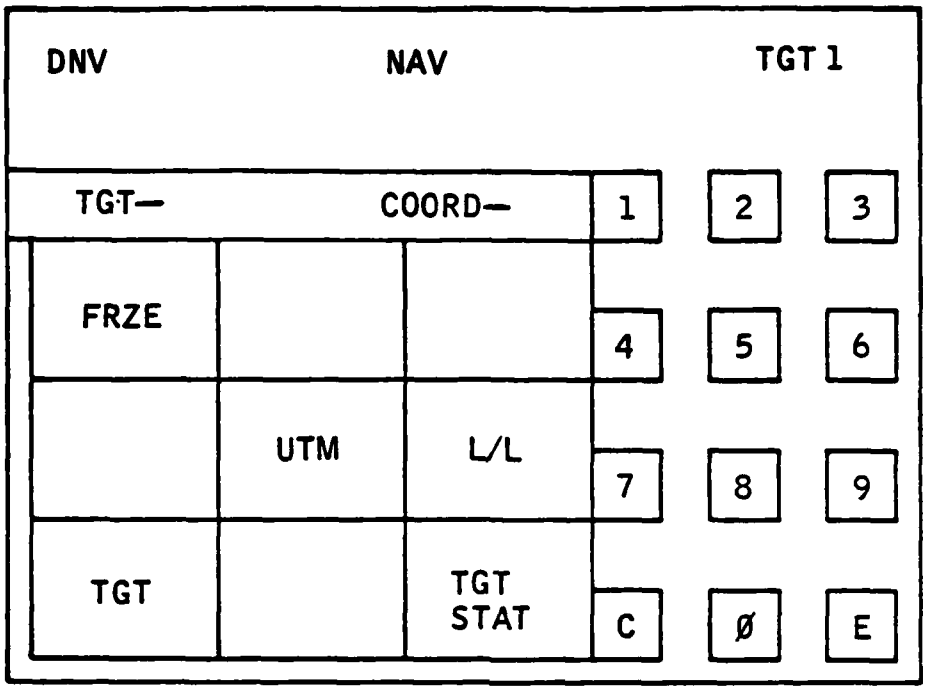


Figure 6.C. Target Entry Format

	Switch	Format
From:	[TGT]	Figure 6
To:	See Text	

This format will be used to enter target coordinates in the same manner as the checkpoint coordinates were entered. The only difference between Figure 6.B and Figure 6.C is that [TGT] is used in Figure 6.C. The sequence of Target coordinate entry is the same as checkpoint coordinate entry starting at Figure 6.B.

To Freeze a target without presetting a target number, depressing [FRZE] then [E] over desired target point will enter target coordinates in the last entered coordinate system in non use target positions 6-9.

If specific target number is desired, enter [FRZE] + numeric 0-9.

For freeze entries, after depressing [E] the coordinates and the target number of frozen point are displayed on the 2nd line.

If it is desired to change the target number, depressing a numeric and [E] will revise auto selected target number.

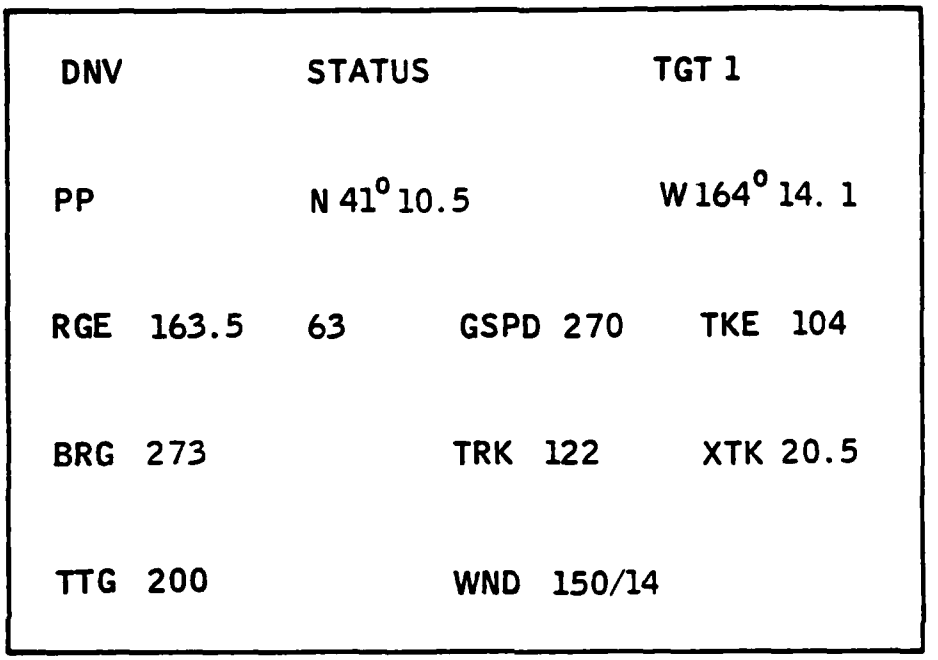


Figure 6.D. Navigation Status Display

	Switch	Format
From:	[NAV STAT]	Figure 6
To:	[SUB]	Figure 6

This page will display all of the flight information in one page. Return to the DNV submode format will be by selection of the fixed function switch [SUB].

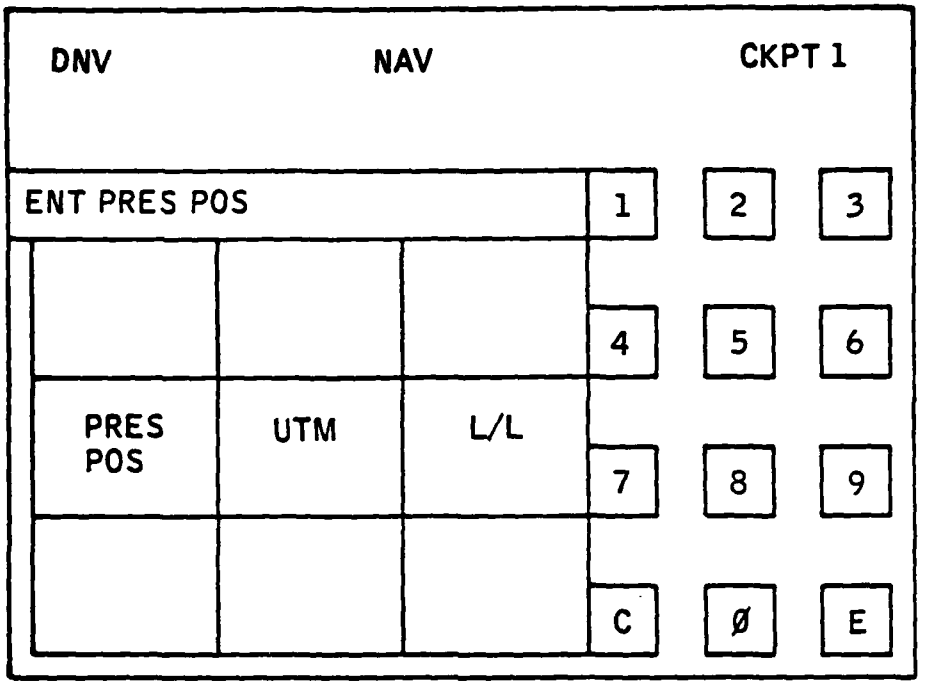


Figure 6.E. Present Position Entry Format

	Switch	Format
From:	[PRES POS]	Figure 6
To:	See text.	

This format is used to enter the present position in UTM or LAT/LONG coordinates. Selection of UTM or L/L will display the function Figure 6.B.1 or Figure 6.B.2 for coordinate entry in the same manner as the checkpoint coordinate entry was performed.

The only difference in the function is that [PRES POS] will display rather than [CKPT].

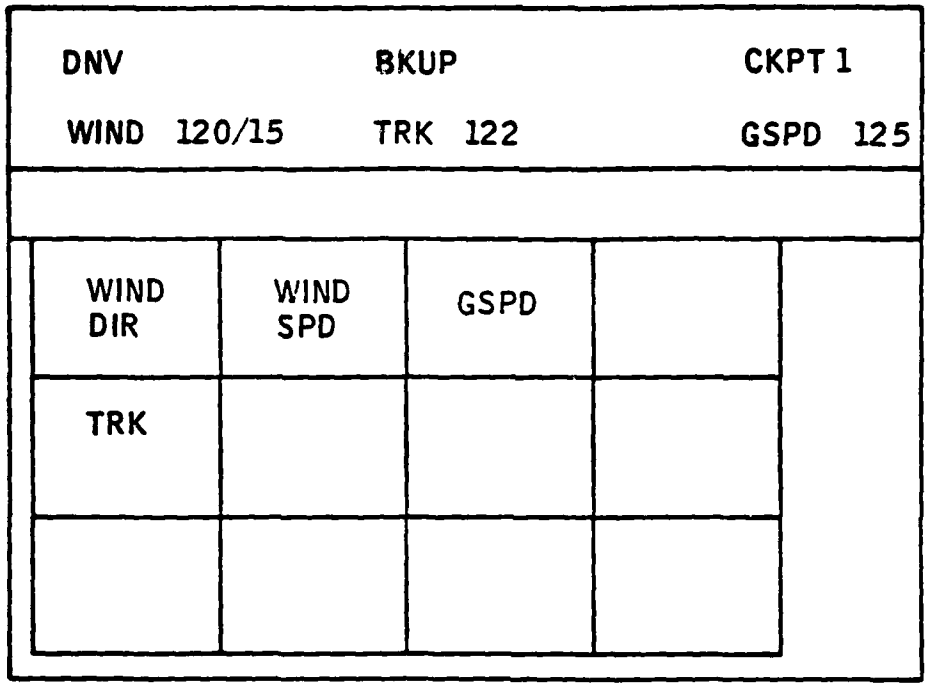


Figure 6.F. Backup NAV Format

	Switch	Format
From:	[BKUP NAV]	Figure 6
To:	[WIND DIR]	Figure 6.F.1
	[WIND SPD]	Figure 6.F.2
	[GSPD]	Figure 6.F.3
	[TRK]	Figure 6.F.4

This format is used to provide estimated information for the Backup mode in D NAV when the Radar is inoperative but the computer is still functioning. Selection of any of the switches will display that format for entry of data.

[STEP] may be used to bypass menus in the back-up mode.

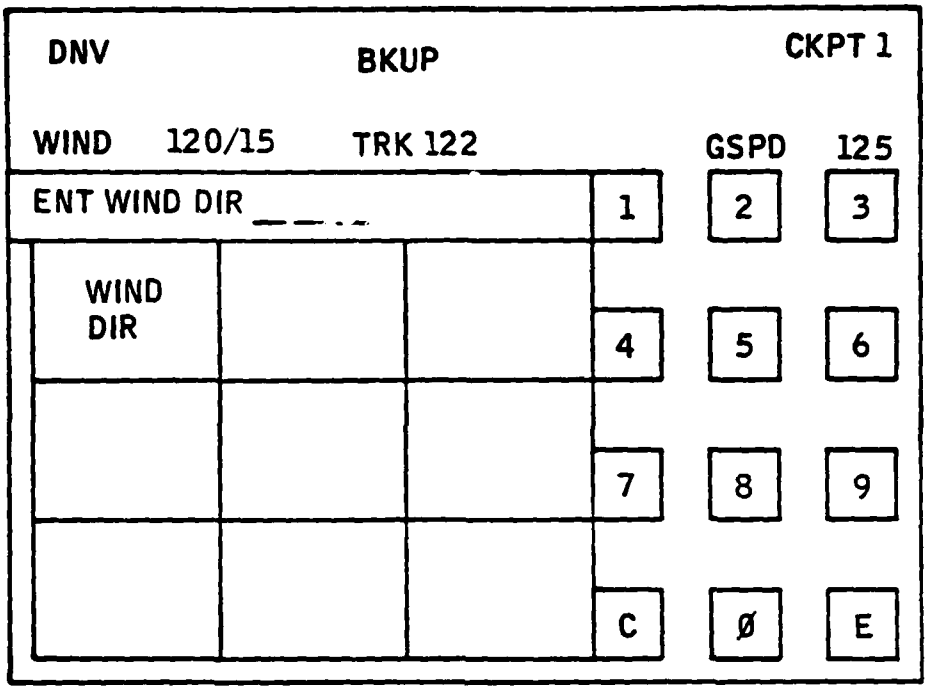


Figure 6.F.1. WIND Direction Entry Format

	Switch	Format
From:	[WIND DIR]	Figure 6.F
To:	[E]	Figure 6.F

This format is used to enter estimated Wind direction.

1. Enter Three numerics for Wind direction from the keyboard. The number will display on the legend line as entered.

2. Select [E] to enter the data to the computer. Figure 6.F will display with the Wind direction displayed in the Second line.

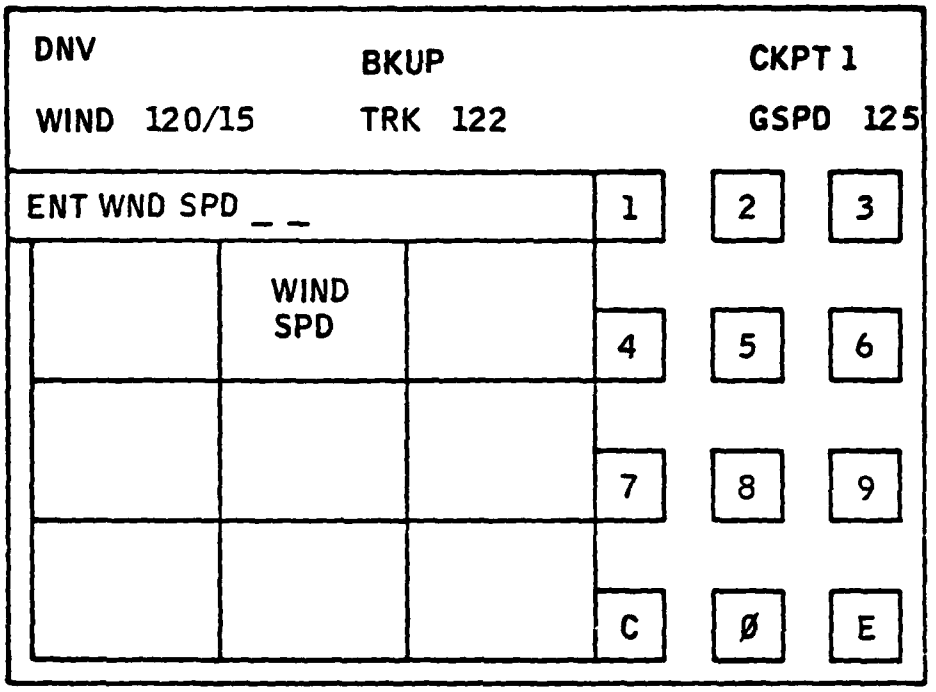


Figure 6.F.2. Wind Speed Entry Format

	Switch	Format
From:	[WIND SPD]	Figure 6.F
To:	[E]	Figure 6.F

This format is used to enter an estimated wind speed in the backup mode of operation.

1. Enter a Two digit number for wind speed from the keyboard. The number will appear in the legend line.

2. Selection of [E] will enter the data to the computer and display Figure 6.F with the wind speed displayed in the Second line.

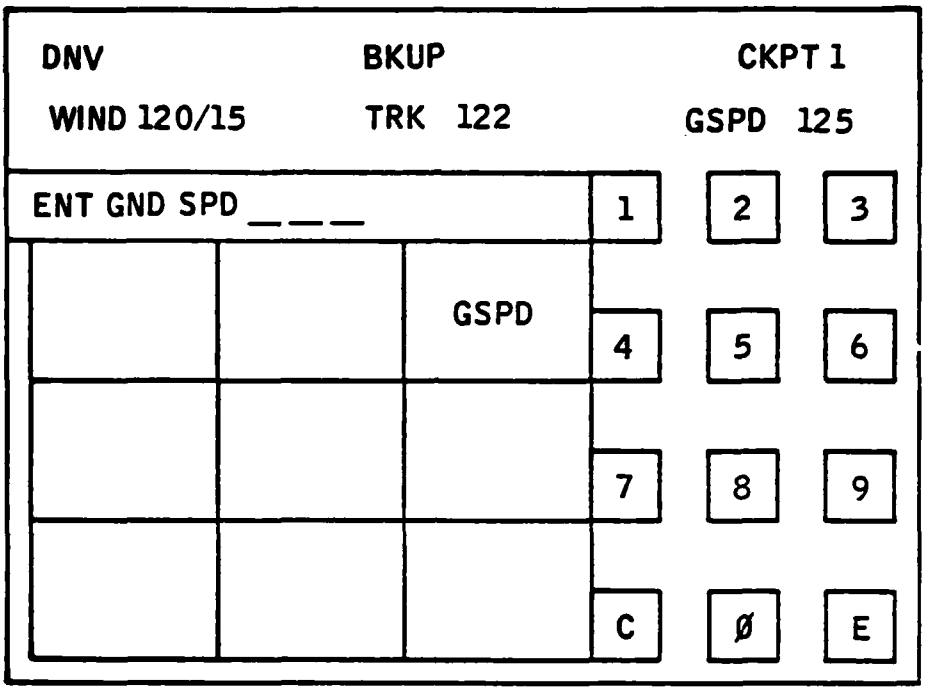


Figure G.F.3. Ground Speed Entry Format

	Switch	Format
From:	[GSPD]	Figure 6.F
To:	[E]	Figure 6.F

This format is used to enter an estimated ground speed in the event of a Radar failure.

1. Enter a three digit number for the estimated ground speed from the numeric keyboard. The number will display in the legend line.

2. Selection of [E] will enter this data to the computer and display Figure 6.F with the ground speed displayed in the second line.

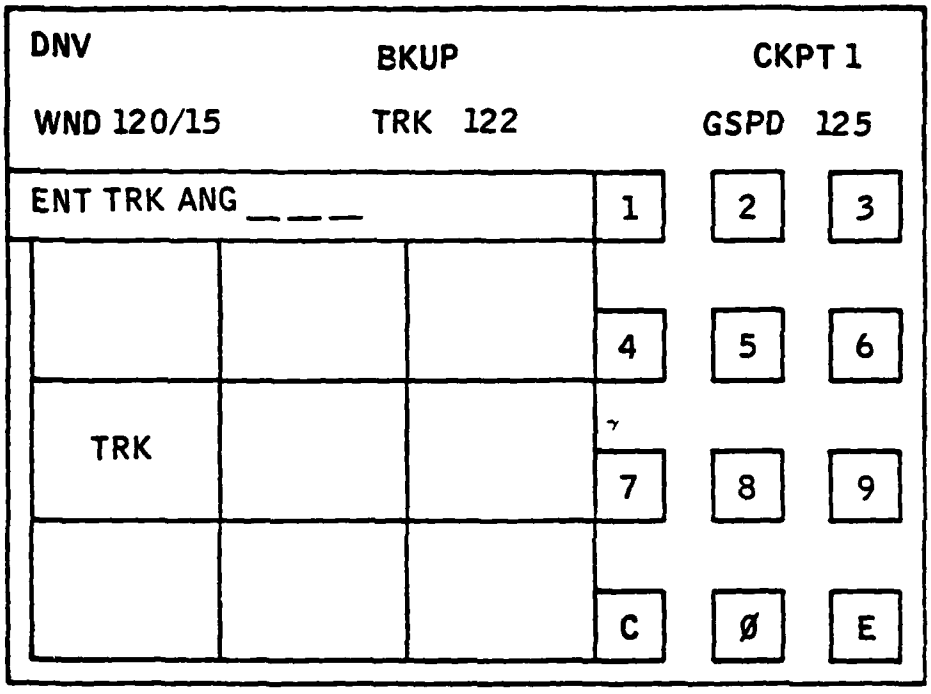


Figure 6.F.4. Track Entry Format

	Switch	Format
From:	[TRK]	Figure 6.F
To:	[E]	Figure 6.F

This format is used to enter an estimated Track in the event of a radar failure.

1. Enter a three digit Track Angle using the numeric Keyboard. The number will display in the legend line.
2. Selection of [E] will enter this data to the computer and display Figure 6.F with the TRK Angle displayed in the Second line.

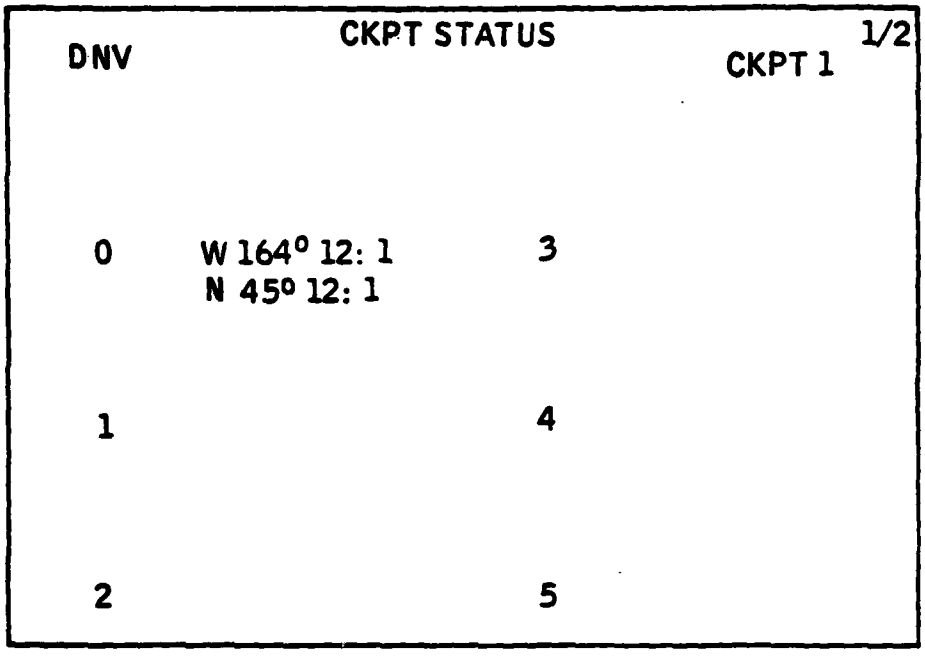


Figure 6.G. Checkpoint Status Display

	Switch		Format
From:	[CKPT STAT]		Figure 6
To:	[CKPI 0]	thru	Figure 6.B
	[CKPT 9]		

This format is used to display the status of the checkpoints showing each Checkpoint with its coordinates. A checkpoint can be selected for coordinate change from this format by pressing on the CKPT Legend. Figure 6.B will display with the selected Checkpoint numerical displayed. New coordinates can be entered in the same manner as were used for original checkpoint entries.
This information will appear on two pages 0-5 on page 1/2 & 6-9 on page 2/2.

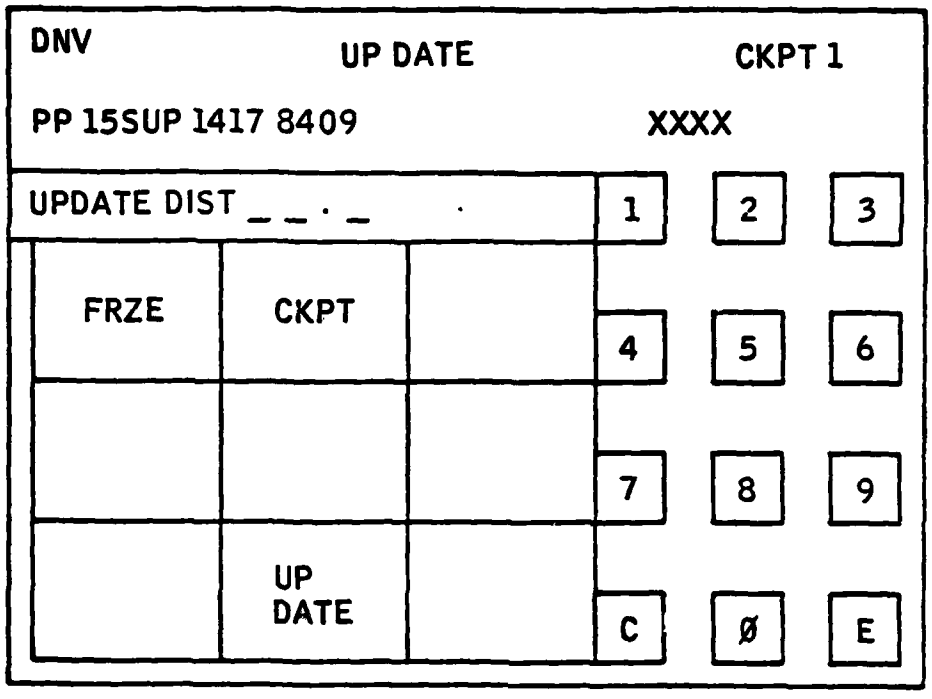


Figure 6.H. Update Formats

	Switch	Format
From:	[UP DATE]	Figure 6
To:	[FRZE]	Figure 6.H
	[UP DATE]	Figure 6

This format will be used to update present position from a stored checkpoint. The update can be accomplished in one of the two following ways:

1. Update to Existing Checkpoint

   An existing checkpoint that has its coordinates already entered into the system can be used to update present position in the following manner.

   A. Select [UP DATE] prior to arriving at the checkpoint. Update format Figure 6.H will display.

B. Select [CKPT] and numeric to indicate the update will be made in reference to the checkpoint displayed. If checkpoint displayed is the desired reference point proceed to step C.

C. Select [FRZE] when the selected checkpoint is flown over. This action will store the coordinates of the checkpoint as computed by the Navigation system and compare them to the previously entered checkpoint coordinates. The difference in Range will be displayed in the legend line with "UPDATE DIST" displayed before the number.

D. If the operator elects to update the system, [UP DATE] will be selected to accomplish the update and DNV Submode format Figure 6 will display.

2. Update to New Checkpoint

A new checkpoint or terrain feature can be used for update purposes if the coordinates are known.

A. Select [UP DATE] from Figure 6 prior to reaching the new Terrain feature.

B. Select [NEW] from Figure 6.H to inform the system that the update will be compared against a new set of coordinates to be entered by the operator.

C. The coordinates for the New point can be entered before or after overflying the point. When [NEW] is selected, prompting will display in the legend line for the coordinate system that is presently in the system. The operator will select [DATA ENT] to enter L/L or UTM in the previously described manner.

D. As the New point is overflown selection of [FRZE] computed coordinates of the point for comparison with the entered coordinates. The difference will be displayed in the second line of the display.

E. The operator can select to update the system by activating [UP DATE]. The display will return to Figure 6.

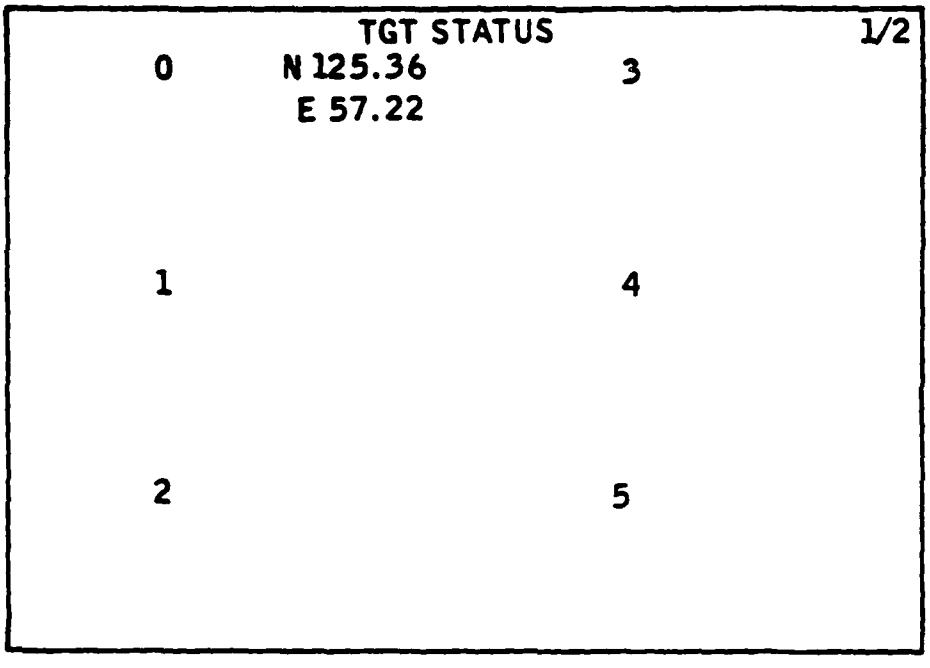


Figure 6.1 Target Status Display

	Switch	Format
From:	[TGT STAT]	Figure 6
To:	[PRI]	Fixed

This display is used to display the status of the Targets. The system will have the capability to store up to 10 targets with the coordinates.

This display will be on two pages. Targets 0-4 on page 1/2 & 5-9 on page 2/2.

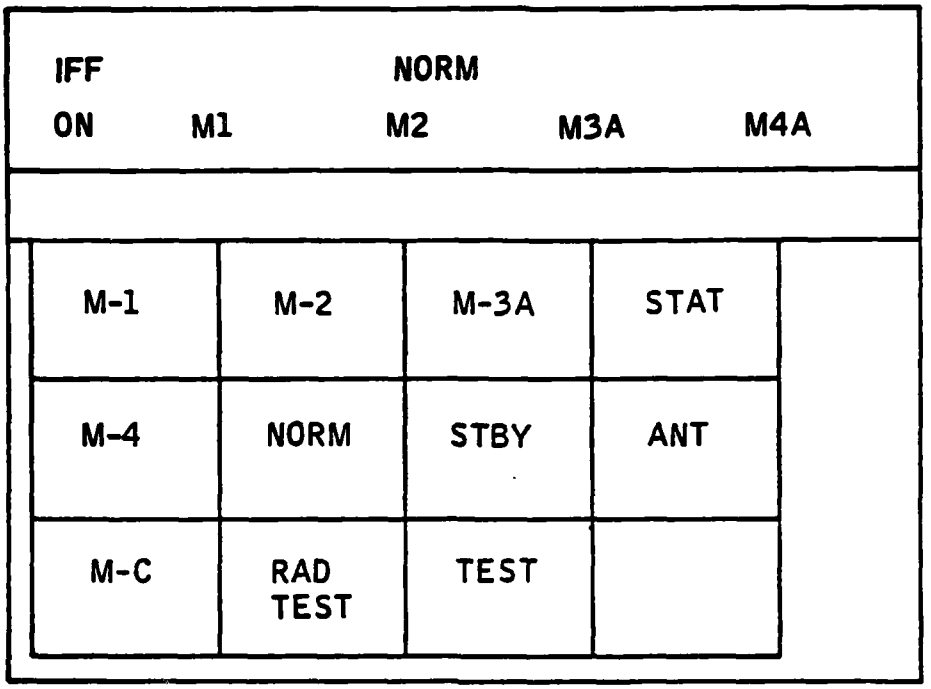


Figure 7. . IFF Submode

	Switch	Format
From:	IFF	Figure 1
To:	M-1	Figure 7. A
	M-2	Inserted as fixed data in ROM
	M-3A	Figure 7. C
	M-4	Figure 7. D
	ANT	Figure 7. E
	M-C	Figure 7
	NORM	Figure 7
	STBY	Figure 7
	RAD TEST	Figure 7
	TEST	Figure 7

"NORM" - Activation of "NORM" will place the IFF in the normal mode of operation and display "NORM" on the top line of the display.

"STBY" - Activation of this switch will place the IFF in the standby mode and display "STBY" in the top line of the display.

"RAD TEST" - Activation of this momentary switch will enable the IFF to test its receive functions with the help of an outside source.

"TEST" - Activation of ["TEST"] and then any of the mode switches M-1 through M-4 will request a test of that IFF function. The test results will be displayed in the second line of the display.

To turn any modes (M-1 to M-4) on, use the following procedure: EX: M-1

Select the mode by pressing [M-1] ; then [ON] MI will appear in the 2nd line.

To turn any mode off, use the following procedure: EX: M-1

Press [M-1] then [OFF] MI will be deleted from the 2nd line.

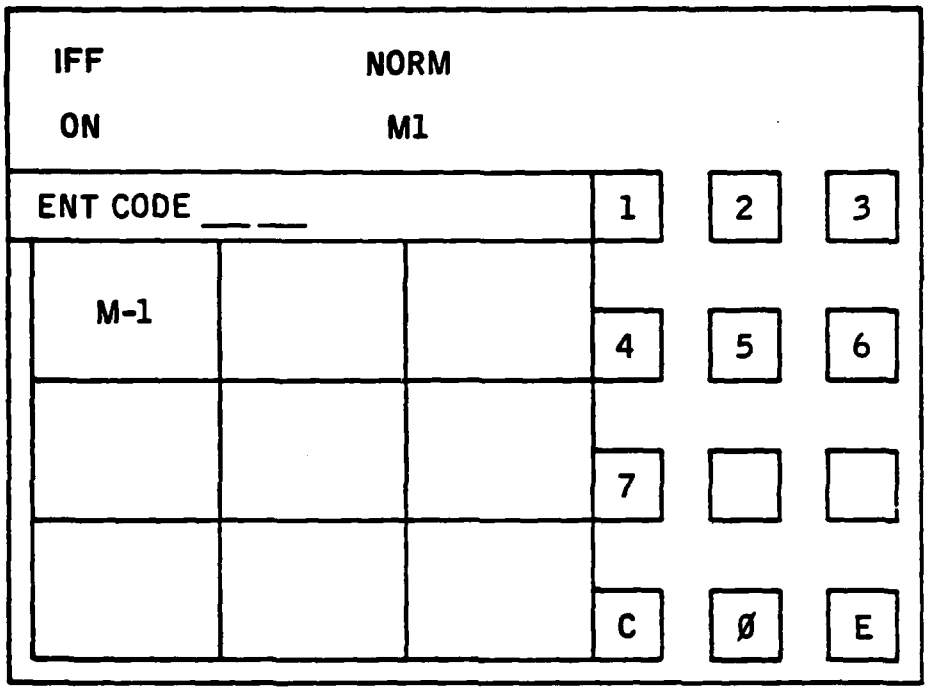


Figure 7.A. M-1 Code Format

	Switch	Format
From:	[M-1]	Figure 7
To:	[E]	Figure 7

This format is used to enter the M-1 code for the IFF and operator in the following manner:

1. [M-1] CODE will be displayed in the legend line. The code will be entered by selection from the numeric keyboard. Legal entries are from 00 to 73.
2. ["C"] can be used to clear the entry as in previous formats.
3. ["E"] will be used to enter the code and will switch the display back to Figure 7, where M-1 and its code will be displayed in the top line of the display.

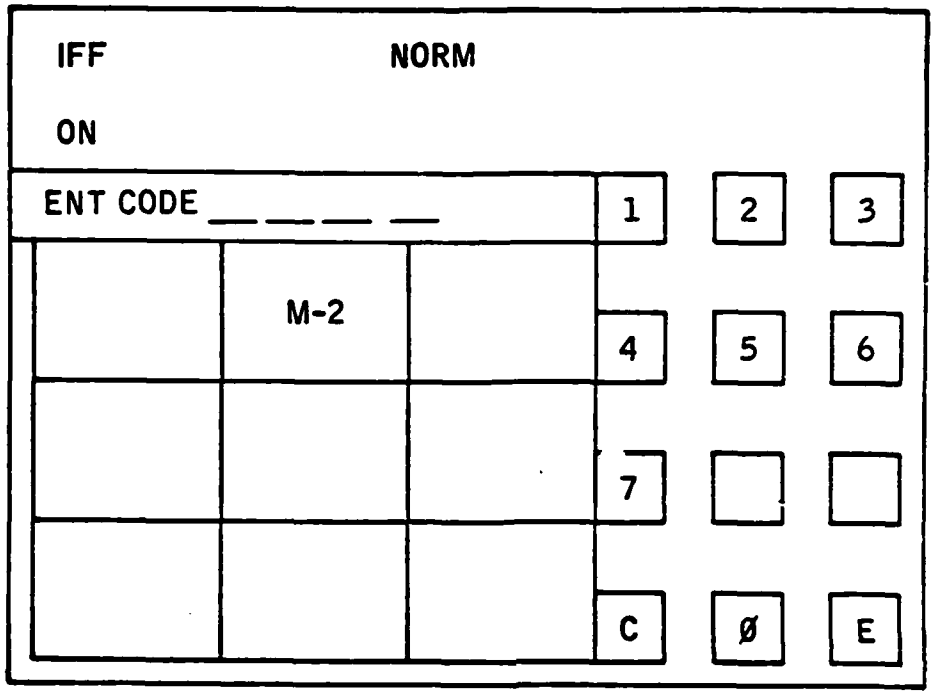


Figure 7.B. M-2 Code Format

	Switch	Format
From:	(M-2) (GARD)	Figure 7
To:	E	Figure 7

This format will be used to enter the M-2 code which is a guarded code:

1. [M-2] CODE will be displayed in the legend line. The code will be entered by selection from the numeric keyboard. Legal entries are from 0 to 7777.
2. ["C"] can be used to clear the entry for corrective purposes as described previously.
3. ["E"] will enter the M-2 code to the system and return the display to Figure 7.

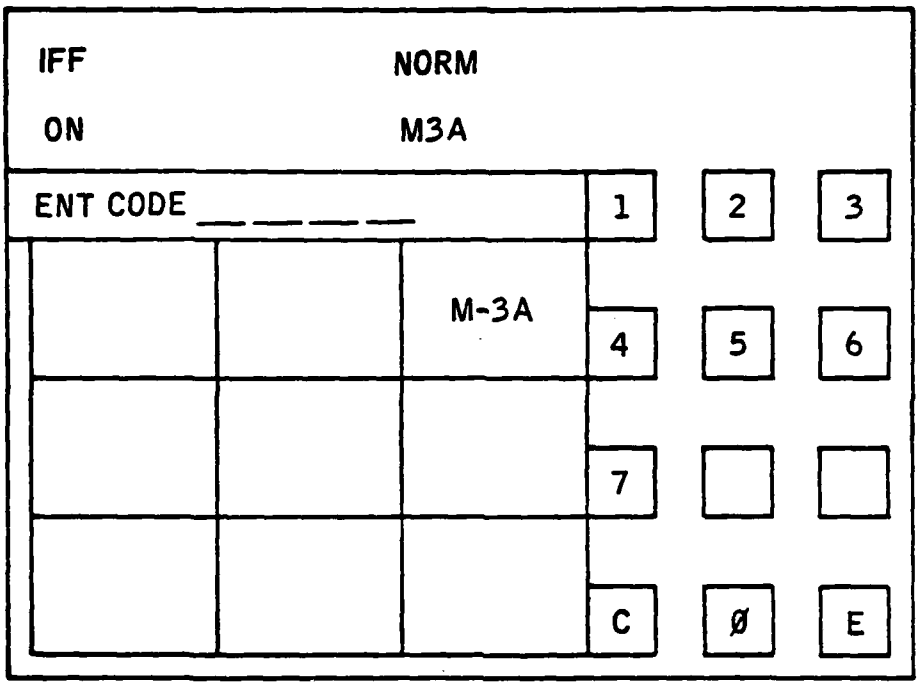


Figure 7-C. M-3A Code Format

	Switch	Format
From:	M-3A	Figure 7
To:	E	Figure 7

This format is used to enter the M-3A code:

1. [M-3A] CODE will display in the legend line. Variation for the code will be entered by use of the numeric keyboard. Legal entries from 0 to 7777.
2. ["C"] may be used to clear the entry for corrective purposes as described previously.
3. ["E"] will be used to enter the new code to the IFF system and will return the display to Figure 7.

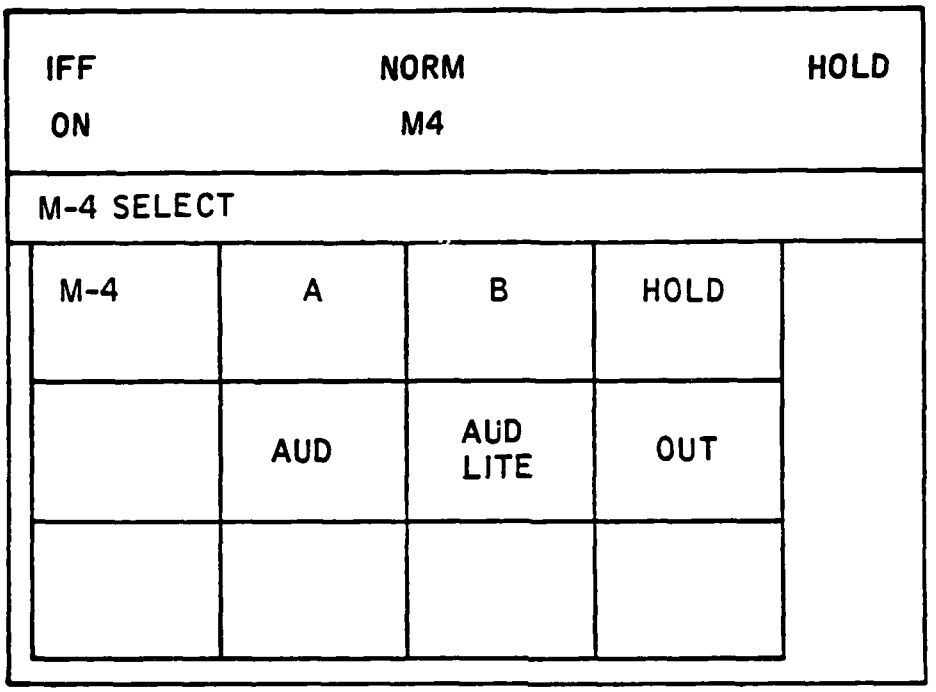


Figure 7.D. M-4 Mode Formats

	Switch	Formats
From:	M-4	Figure 7
To:	A	Figure 7
	B	Figure 7
	HOLD	Figure 7
	AUD	Figure 7
	AUD LITE	Figure 7
	OUT	Figure 7

This format is used to select the M-4 mode of operation in the following manner:

1. ["A"] - Selection of this switch will place the IFF in the M-4A mode and display "M-4A" in the top display line.
2. ["B"] - Selection of this switch will place the IFF in the M-4B mode and display "M-4B" in the top display line.
3. ["HOLD"] - Selection of this switch will place the IFF in the hold mode and display "HOLD" in the top display line. Mode 4 code will be retained if power is not turned off for 15 seconds.

4. [AUD] - Selection of this switch will place the IFF in the AUD mode and display "AUD" in the second line display line.

5. [AUD LITE] - Selection of this switch will place the IFF in the audio and light mode and display "AUD LITE" in the second display line.

6. [OUT] - Selection of this switch will turn the AUD or AUD LITE mode off.

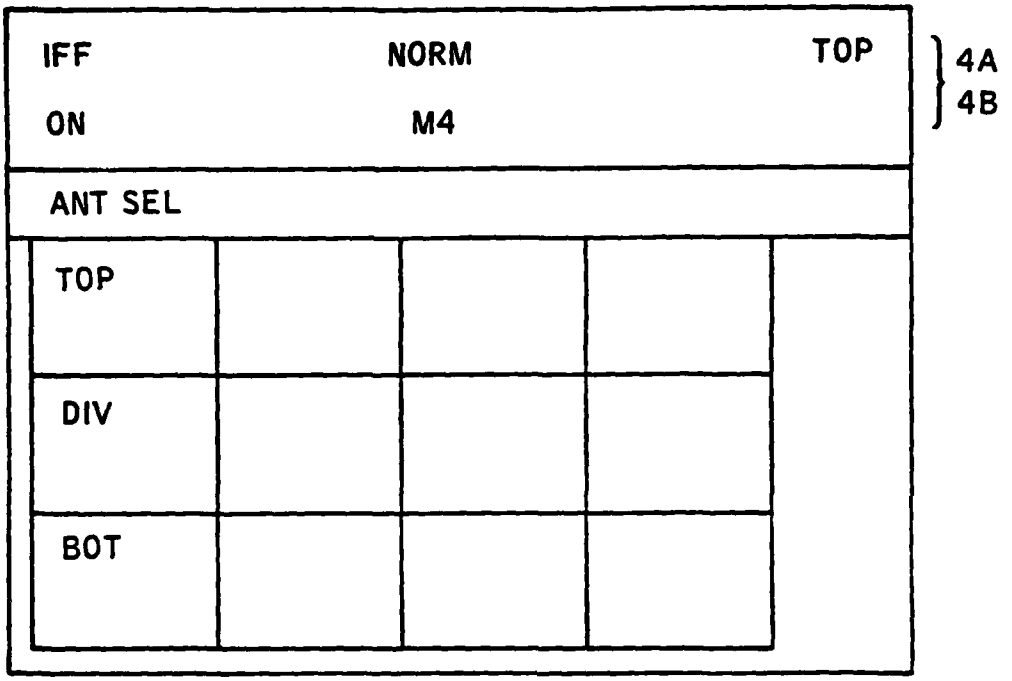


Figure 7.E. ANT Mode Format

	Switch	Format
From:	ANT	Figure 7
To:	TOP	Figure 7
	DIV	Figure 7
	BOT	Figure 7

This format is used to select the antenna mode:

1. ["TOP"] - Selection of this switch will place the antenna in the top pattern and display ["TOP"] on the second line of the display in Figure 6.
2. ["DIV"] - Selection of this switch will place the antenna in the divided antenna pattern and display DIV on the second line of the display in Figure 6.
3. ["BOT"] - Selection of this switch will place the antenna in the bottom antenna pattern and display ["BOT"] in the second line of the display in Figure 7.

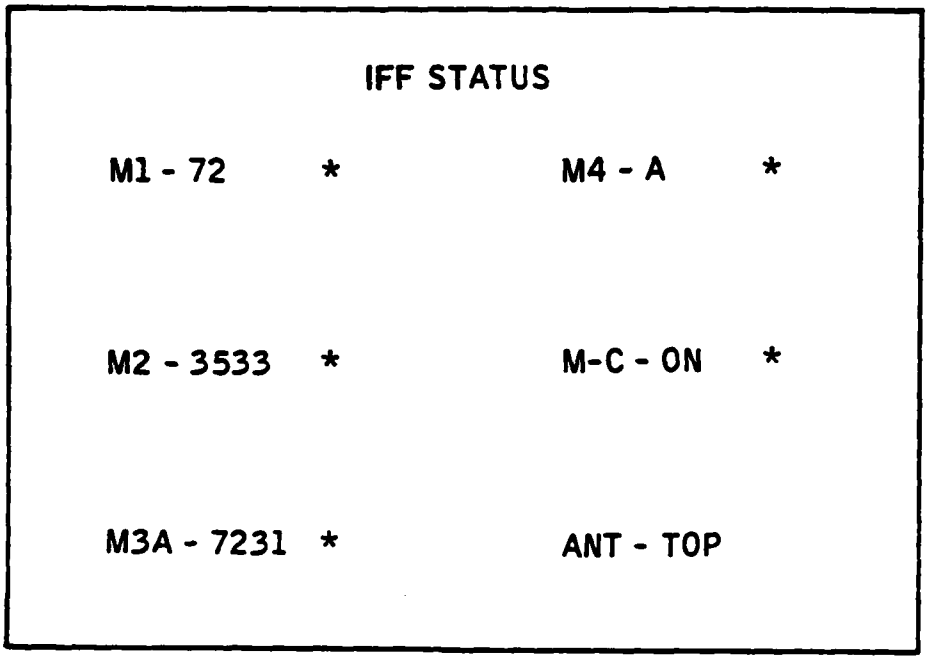
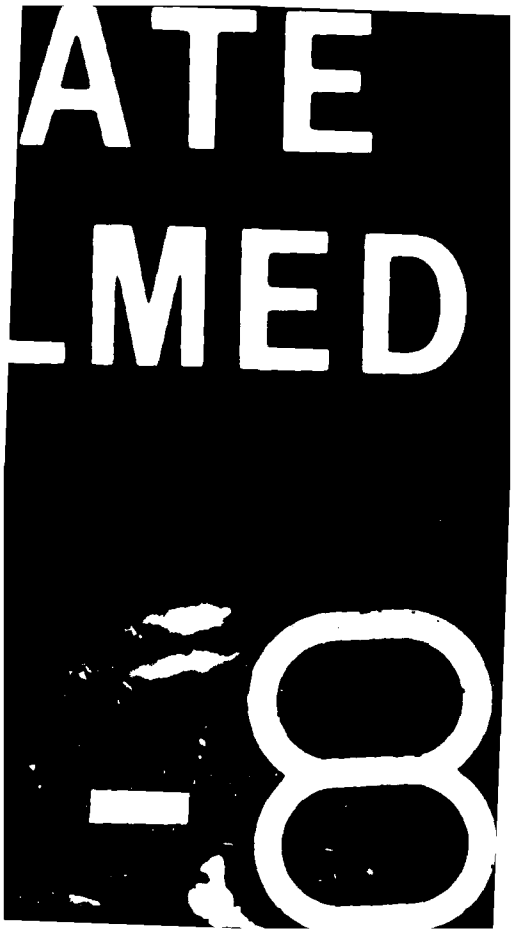


Figure 7. F Stat Page

	Switch	Format
From:	[STAT PAGE]	Figure 2
To:	See text.	Figure 2. B

This format is primarily a review of IFF status. Active modes are indicated by the asterisk symbol. Return to any mode may be selected for re-assignment in the following manner:

1. Select mode for re-assignment by pressing on mode legend.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